Telephony

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Mathematics For Telephone Engineers

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FOURTH ARTICLE of mathematics series, designed to enable the reader to handle alternating current problems, especially those relating to telephone transmission. This article deals with quadratic equations and their solution by factorization, by completion of the square and by formula. The series began in the issue of May 30, with the second and third articles appearing in the June 27, July 25 issues, respectively

AN EQUATION in which the square but no higher power of the unknown exists, is termed a "quadratic equation." The simplest type is the *pure* quadratic, such as $x^2 = 36$, which is solved by taking the square root of both sides, x is either $+6$ or -6 because both $(+6)^2$ and $(-6)^2$ are equal to 36. This is usually written $x = \pm 6$ or "x equals plus or minus 6."

While the two solutions should be shown in the result, where the equation refers to some practical case, the conditions will generally be such that the negative solution is inadmissible and the positive solution is indicated as the one required.

$x^2 + 11x + 30 = 0$ is a quadratic equation containing the first and second power of the unknown and is termed an *adfected* quadratic.

There are three methods by which such equations can be solved—by factorization, by completion of the square and by formula.

Solution by Factorization

This solution by the factorization method involves the ability to throw an expression into its factors. The factorized form of an expression frequently reveals properties which are not apparent in the original.

An expression frequently contains a common factor. The removal of this and placing it outside an enclosing bracket containing the expression reduces the work of multiplication.

Example 1:

$$36 + 54 - 27 = 63$$

This may be written,

$(9 \times 4) + (9 \times 6) - (9 \times 3) = 63$, or

$9\,(4 + 6 - 3) = 9\,(10 - 3) = 63$

Example 2:

$9a^2b^2 - 18a^2b^2c + 36a^6b^4c^2 \ldots\ldots (a)$

9 is common to all terms. a^2 is the highest power of a common to each term and b^2 the highest power of b common to all terms. c occurs in the second and third terms and is not common to all.

$9a^2b^2$ is, therefore, the factor to be taken outside the brackets and the expression (a) reduces to

$9a^2b^2\,(a^2b - 2ac + 4a^4b^2c^2) \ldots\ldots (b)$

Example 3:

$(A + B)\ (A - B) = A^2 - B^2$.

Therefore, to factorize the difference of two squares, multiply the sum of the two quantities by their difference.

Example 4:

$$(8{,}676)^2 - (8{,}540)^2.$$

Using the last result, this is written

$(8{,}676 + 8{,}540) \times (8{,}676 - 8{,}540)$

$= 17{,}216 \times 36$

$= 619{,}776$

This is a much quicker operation than squaring each quantity and subtracting the results.

$$(x + a) \times (x + b) = x^2 + x\,(a + b) + ab$$

The above is quadratic expression with unity as the coefficient of x^2. There are, further, two numbers whose sum is the coefficient of x and whose product is the third term.

Example 1:

$$x^2 + 7x + 12$$

Here $ab = 12$

$(a + b) = 7$

The two numbers are obviously 4 and 3 $(4 \times 3) = 12$, $(4 + 3) = 7$; therefore, $x^2 + 7x + 12 = (x + 4) \times (x + 3)$.

Example 2:

$$x^2 + 9x + 18$$

$18 = 1 \times 18,\ 2 \times 9,$ or 3×6

and, clearly, the two numbers are 6 and 3. Therefore,

$x^2 + 9x + 18 = (x + 3) \times (x + 6)$.

Example 3:

$$x^2 + x - 12$$

The product is -12 and, therefore, one number must be positive. The sum is $+1$ and the positive number is, therefore, the greater. Also, $12 = 2 \times 6$ or 3×4.

4×-3 fulfills the conditions of the original expression whose factors are, therefore, $(x + 4)$, $(x - 3)$.

Example 4:

$$x^2 - x - 12$$

Again the product is negative. The sum, -1, is negative and, therefore, the

negative number is the greater. -4×3 fits the conditions and the factors are $(x-4)$, $(x+3)$.

Example 5:

$$x^2 - 9x + 20$$

The product 20 is positive so both numbers are either positive or negative. The sum -9 is negative and as they are both of the same sign, they are both negative. The factors are:

$$(x-4),\ (x-5)$$

Example 6:

$$-x^2 + xy + 42y^2 = -(x^2 - xy - 42y^2)$$
$$= -(x-7y)\ (x+6y)$$
$$= (7y-x)\ (x+6y)$$

Example 7:

$$4x^2 - 14x + 12 = (2x)^2 - 7\ (2x) + 12$$
$$= (2x-3)\ (2x-4)$$

In this example the coefficient of x^2 is the square of a factor, 2, which occurs in the coefficient of x.

A quadratic expression $ax^2 + bx + c$ can be resolved into factors if the middle term, bx, can be separated into two parts such that when multiplied together their product is acx^2.

Example 1:

$$3x^2 + 10x + 7$$

$acx^2 = 21x^2$ and $10x = 7x + 3x$ whose product is also $21x^2$. The factors are, therefore, $(3x+7)\ (x+4)$.

Example 2:

$$5x^2 + 27x + 28 = 5x^2 + 7x + 20x + 28$$

and the factors are $(5x+7)\ (x+4)$.

Example 3:

$$x^2 + x - 30 = x^2 + 6x - 5x - 30$$
$$= (x+6)\ (x-5)$$

Example 4:

$$4x^2 + 16x + 15 = 4x^2 + 6x + 10x + 15$$
$$= (2x+3)\ (2x+5)$$

Below are given some important expressions to bear in mind.

$$(x+y)^2 = x^2 + 2xy + y^2$$
$$(x-y)^2 = x^2 - 2xy + y$$
$$x^2 - y^2 = (x-y)\ (x+y)$$
$$x^3 + y^3 = (x+y)\ (x^2 - xy + y^2)$$
$$x^3 - y^3 = (x-y)\ (x^2 + xy + y^2)$$

To divide a product by a number, divide one of the terms by that number.

Divide $(4x-8)\ (8x-8)$ by 4. This equals $(x-2)\ (8x-8)$, by dividing the first term by 4; or the result is $(2x-4)\ (4x-4)$, by dividing each term by 2, which is equivalent to dividing it in two stages, for 2×2 is equal to 4.

Multiply $(x+4)\ (x-3)$ by 8. This equals $(8x+32)\ (x-3)$, by multiplying the first term by 8; or $(x+4)\ (8x-24)$ by multiplying the second term by 8; or $(2x+8)\ (4x-3)$, by multiplying the first term by 2 and the second by 4.

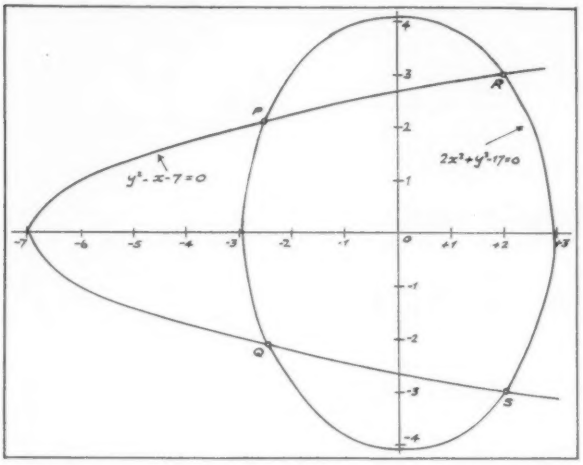

Fig. 22. Graphical Method of Solution of Simultaneous equations When Both Are of the Second Degree.

A pure quadratic equation, such as $x^2 = 100$, is solved by extracting the square root of both sides thus:

$$\sqrt{x^2} = \sqrt{100}$$
$$\text{and}\quad x = 10$$

Since -10×-10 is also equal to 100, the complete answer will be $x = \pm 10$.

A pure quadratic thus has two roots equal but opposite in sign.

$$\text{If } x = 10,\ x - 10 = 0$$
$$\text{and if } x = -10,\ x + 10 = 0$$
$$\text{therefore } (x-10)\ (x+10) = 0$$

If a represents one root of a quadratic equation and b the other, then $x = a$ and $x = b$. $(x-a) = 0$ and $(x-b) = 0$; therefore $(x-a)\ (x-b) = 0$.

Multiplying up,

$$x^2 - (a+b)\,x + ab = 0$$

If a quadratic equation is thrown into the above form, the two roots can be immediately obtained.

$$x^2 - 9x + 20 = 0$$

Example:

The sum of the roots is 9, their product 20; therefore, the roots are -5 and $+4$, and $(x+5)\ (x-4) = 0$, since if one factor is zero, the product of the two factors must be zero also.

Since

$x = -5$, $(x+5)\ (x-4 = -0 \times 9 = 0$.

and

$x = \quad 4$, $(x+5)\ (x-4) = \quad 0 \times 9 = 0$.

As the equation has two dissimilar roots, it is evidently not a perfect square. For this to be so the roots would have to be equal numerically and of the same sign. Thus,

$x^2 + 6x + 9$ is the square of $\pm(x+3)$

$x^2 + 8x + 16$ is the square of $\pm(x+4)$

$x^2 - 10x + 25$ is the square of $\pm(x-5)$

It will be noted that in all these cases the third term is the square of half the coefficient of x. Thus, $9 = 3^2 = (6/2)^2$, $16 = 4^2 = (8/2)^2$ and so on.

Solution by Completion of the Square

This leads to the second method of solving a quadratic equation—solution by completion of the square.

Example 1:

$$x^2 + 4x = 45$$

Add the square of half the coefficient of x, $(4/2)^2$ to both sides. Then, $x^2 + 4x + 4 = 49$.

Taking the square root of both sides:

$x + 2 = \pm 7$

$x = 7 - 2 = 5$ or

$x = -7 - 2 = -9$

Example 2:

$$x^2 - 7x = 18$$

Completing the square,

$x^2 - 7x + (7/2)^2 = 18 + (7/2)^2$.

$x + 7/2 = \pm \sqrt{30.25}$

$x = 2$ or $x = -9$

Solution by Formula

In the third method of solving—solution by formula—all quadratic equations reduce to the general form,

$$Ax^2 + Bx + C = 0$$

If the method of completing the square is applied to this expression, a formula will result which will give the roots of any quadratic equation when the values of A, B, and C are substituted.

Divide the general expression above by A and, transposing C, there result:

$$x^2 \times \frac{B}{A}x = -\frac{C}{A}$$

Adding the square of half the coefficient of x to both sides,

$$x^2 + \frac{B}{A}x + \left(\frac{B}{2A}\right)^2 = -\frac{C}{A} + \left(\frac{B}{2A}\right)^2$$
$$= -\frac{C}{A} + \frac{B^2}{4A^2}$$
$$= \frac{B^2 - 4AC}{4A^2}$$

and

$$\left(x + \frac{B}{2A}\right)^2 = \frac{B^2 - 4AC}{4A^2}$$

Extracting the square root,

$$x + \frac{B}{2A} = \pm \frac{\sqrt{B^2 - 4AC}}{2A}$$

From which

$$x = -B \pm \frac{\sqrt{B^2 - 4AC}}{2A}$$

The roots of the general quadratic expression are, therefore,

$$-B + \frac{\sqrt{B^2 - 4AC}}{2A} \text{ and}$$

$$-B - \frac{\sqrt{B^2 - 4AC}}{2A}$$

Example:

$$-2x^2+2x+12=0$$

$$x=\frac{2\pm\sqrt{4+96}}{4}=\frac{2+\sqrt{100}}{4}=3 \text{ or}$$

$$=\frac{2-\sqrt{100}}{4}=-2$$

These results can be verified by inserting them in the original equation.

Simultaneous Quadratic Equations

If two simultaneous equations exist, one containing the first powers only of the unknowns and the other the second powers (such equations are referred to as being of the first and second degrees respectively), they can be solved as follows:

Let

$$3x-2y=6 \ldots\ldots (1)$$

$$x^2-3xy-y^2=-29 \ldots. (2)$$

From (1), $x=\frac{6-2y}{3}$

Substituting in (2)

$$\frac{36-24y+y^2}{9}-3y\left(\frac{6-2y}{3}\right)-y^2=-29$$

Therefore,

$$\frac{36-24y+y^2}{9}-y(6-2y)-y^2+29=0$$

Or, $36-24y+4y^2-54y-18y^2-9y2+261=0$

And, finally,

$$-23y^2-78y+297=0.$$

Changing the signs in order to make the first term positive,

$$23y^2+78y-297=0$$

The factors of this expression are,

$$(23y+99)(y-3)=0$$

Therefore, $y=3$ and substituting this value in (1), $x=4$.

Also,

$$23y=-99$$

Therefore, $y=\frac{99}{-23}=-4.304$

Substituting this in (1), $x=-0.8693$.

These results should be verified by seeing that they satisfy equation (2).

Taking the first solution, (2) becomes

$$16-36-9=-29$$

which is obviously correct.

In the same way it will be found that by taking the second set of roots and calculating the value of (2), they are correct.

When both equations are of the second degree, there is no general method of solution but a graphical method may be adopted.

Example:

$$2x^2+y^2-17=0 \quad (1)$$

$$y^2-x-7=0 \quad (2)$$

Writing $y^2=17-2x^2$, then, if x^2 increases above 3, y^2 becomes negative, and y is said to be *imaginary*.

Values should be tabulated between -3 and $+3$. Also, it is only necessary to calculate values of x from 0 to $+5$ since y is the same numerically for $+x$ or $-x$.

Writing (2) as $y^2=7+x$,

it will be seen that there is no real value of y when x is less than -7. Again, since there is no real value of y beyond the limits of $x=\pm 3$ in (1), it is not necessary to calculate values of x for (2) outside this range. This will be seen by inspecting the graph, Fig. 22. The tables from which the curves of Fig. 22 have been plotted, follow:

x	x^2	$2x^2$	$y^2=17-2x^2$	y
−3	9	18	−1	imag.
−2.5	6.25	12.5	4.5	±2.12
−2	4	8	9	±3
−1.5	2.25	4.5	12.5	±3.54
−1.0	1	2	15	±3.88
−0.5	0.25	0.5	16.5	±3.94
0	0	0	17	±4.125

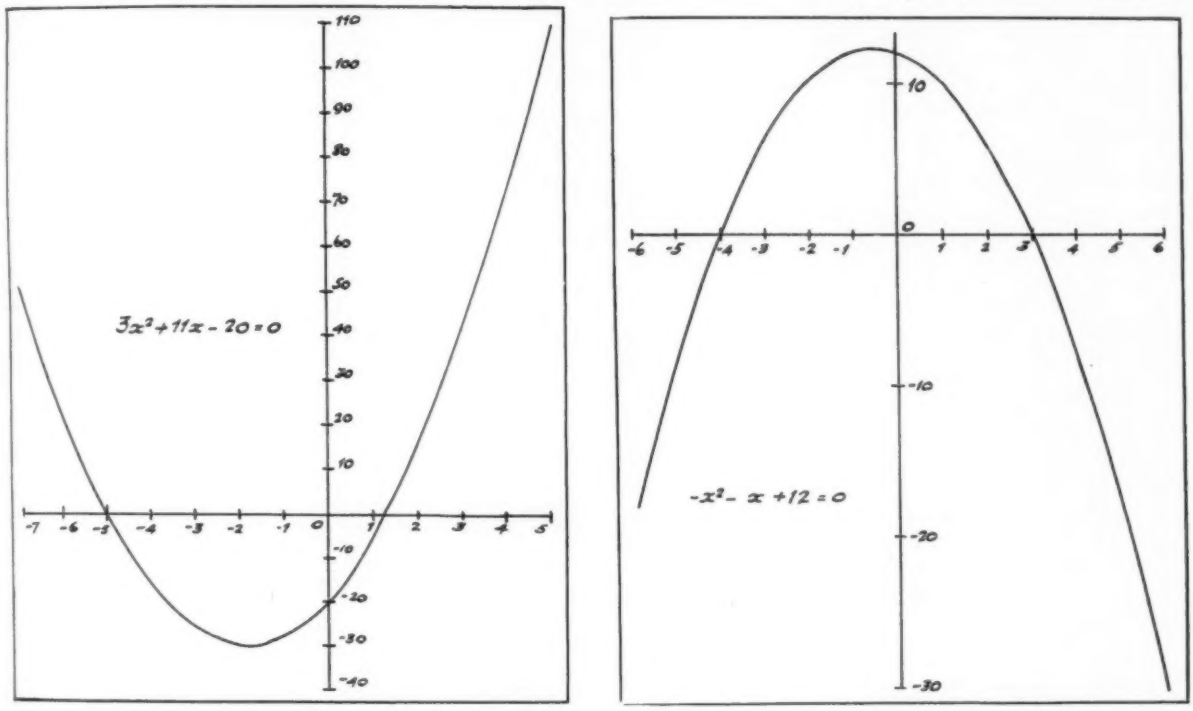

Fig. 23. Graphical Solution for Equations Containing the Second Power of the Unknown Such as $3x^2+11x-20=0$. Curve is a Parabola and Equation Has Two Roots. On the Right is Shown Fig. 24, Curve Similar to That of Fig. 23 for Case Where x^2 is Negative; Roots of Equation are — 4 and + 3.

x	$y^2=7+x$	y
−7	0	0
−6	1	±1
−5	2	$\pm\sqrt{2}$
−4	3	$\pm\sqrt{3}$
−3	4	±2
−2	5	$\pm\sqrt{5}$
−1	6	$\pm\sqrt{6}$
0	7	$\pm\sqrt{7}$
1	8	$\pm\sqrt{8}$
2	9	±3
3	10	$\pm\sqrt{10}$
4	11	$\pm\sqrt{11}$
5	12	$\pm\sqrt{12}$
6	13	$\pm\sqrt{13}$
7	14	$\pm\sqrt{14}$

The intersections PQRS of the two curves give the simultaneous roots.

The Graphical Solution of Equations

Equations containing the second, third or fourth power of the unknown can be solved graphically.

Example: $3x^2+11x-20=0$

Tabulating as follows:

x	x^2	$3x^2 + 11x - 20$	y
−7	49	147 − 77 − 20	50
−6	36	108 − 66 − 20	22
−5	25	75 − 55 − 20	0
−4	16	48 − 44 − 20	−16
−3	9	27 − 33 − 20	−36
−2	4	12 − 22 − 20	−30
−1	1	3 − 11 − 20	−28
0	0	0 − 0 − 20	−20
+1	1	3 + 11 − 20	−6
+2	4	12 + 22 − 20	+14
+3	9	27 + 33 − 20	+40
+4	16	48 + 44 − 20	+72
+5	25	75 + 55 − 20	+110

The resulting curve is a parabola and the roots are −5 and +1.3 (Fig. 23). Fig. 24 is a similar curve for the case where x^2 is negative. It will be noted that the vertex is reversed from that of the previous case.

Fig. 25 is the graph of the cubic equation $x^3 - 6.5x^2 + 3x + 22.5 = 0$. It cuts the x axis at +3, +5 and −1.6, which are the roots of the equation.

Fig. 26 is the curve representing $x4 + 4x^3 - 14x^2 - 36x + 45 = 0$. There are four roots, −5, −3, +1 and +3.

From the last four graphs it will be noted that the number of roots in an expression is the same as the highest power of x in that expression.

In plotting these curves the calculations should be systematically laid out as in the example given. If this procedure is followed, both time and risk of error will be reduced. It is obvious that the curves are only of importance in the neighborhood of the roots, and the curve in the immediaite neighborhood of these should be plotted to a larger scale in order to gain a more accurate result.

The Imaginary Root

The quantity $\sqrt{-16}$ can be considered as $\sqrt{16x}/\sqrt{-1}$ which reduces to $4\sqrt{-1}$. Thus the square root of any negative number can be expressed in the form $b\sqrt{-1}$ where b is a real number. The result of multiplying a real quantity by $\sqrt{-1}$ is to make the product *imaginary*. Take the quadratic equation,

$$x^2 = 12x + 45 = 0$$

Adding the square of half the coefficient of x to both sides,

$$x^2 + 12x + 36 = -45 + 36$$
$$x + 6 = \pm\sqrt{-9}$$
$$= \pm\sqrt{-1}\ (3)$$

Therefore, $x = -6 + 3\sqrt{-1}$ or $-6 - 3\sqrt{-1}$

What interpretation can be applied to such expressions for x?

It has been seen from what has preceded that positive numbers are graphically represented by lengths drawn from left to right along the horizontal or x axis, while negative numbers are represented by similar lines but drawn from right to left along the same axis.

Also, in Article 11, the section on graphical calculation (TELEPHONY of June 25), it was found that the mean proportional between two given straight lines laid end to end was a vertical line drawn from the point of junction of these. Thus, in Fig. 27, OB = +1 is set out in the positive direction along the x axis and OC = −1 in the negative direction. A circle is described on BC as a base and a vertical line from O is cut by the circle at D. Then,

$$\frac{+1}{OD} = \frac{OD}{-1}$$

from which

$$-1 = OD^2$$

or $OD = \sqrt{-1}$

The vertical line is, therefore, a geometrical interpretation of the imaginary quantity $\sqrt{-1}$.

Numbers such as $(+3)\sqrt{-1}$ will, therefore, be represented on the line OD of Fig. 27 which is extended so as to represent as to magnitude the number on a suitable scale. A negative number $(-3)\sqrt{-1}$ will be represented on OD extended downwards. The vertical axis is known as the axis of *imaginaries* and the horizontal axis as the axis of *reals*.

Such a number as $3\sqrt{-1}$ is termed a *quadrature* number and the expression $6 + 3\sqrt{-1}$ (Fig. 28) is a quantity having a real part 6 and an imaginary part $3\sqrt{-1}$. Such an expression is termed a *complex* quantity, being represented graphically by the geometric addition of a horizontal line of magnitude +6 and a vertical line of magnitude +3. Its magnitude or "size is $\sqrt{6^2 + 3^2} = \sqrt{45}$.

In pure mathematics $\sqrt{-}$, is usually represented by *i* but in electrotechnics the letter *j* is adopted. $6 + 3\sqrt{-1}$ would be expressed symbolically as a + jb. j will be used throughout in this series as a symbol for $\sqrt{-1}$.

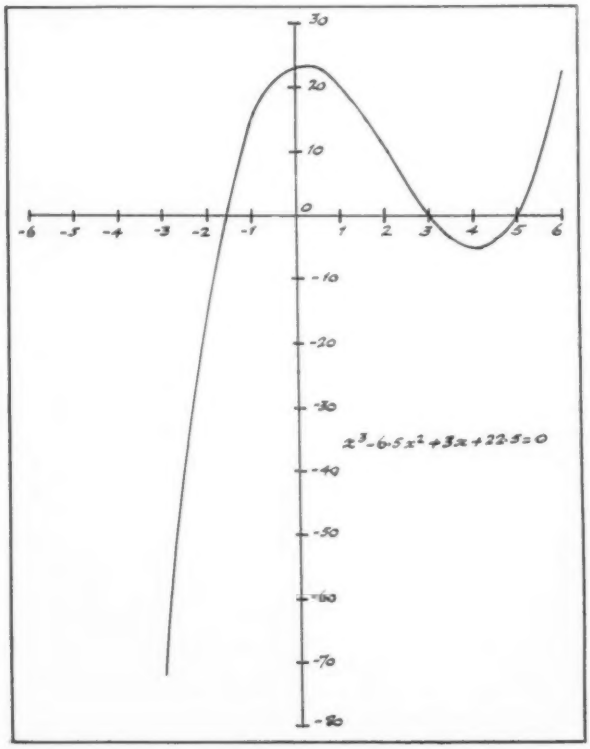

Fig. 25. Graph of a Cubic Equation.

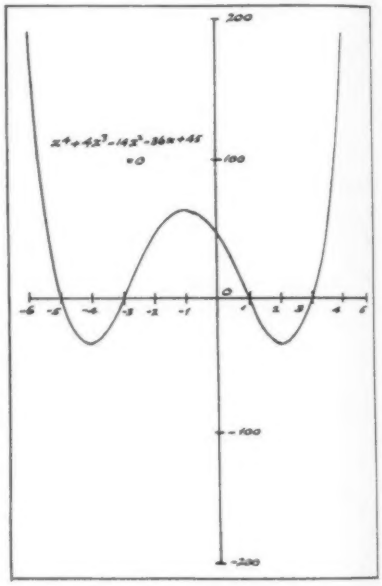

Fig. 26. Curve, the Equation for Which Has Four Roots.

J Regarded as an Operator

If a number n is taken—represented to a certain scale by a horizontal line—and multiplied by (−1), a number −n is obtained, represented by the same horizontal line as to magnitude but reversed as to direction.

Multiplication of the line representing n by −1 may be regarded as a process of rotation, reversing the sign of a number and, consequently, reversing the line representing that number. The angle turned through is 180 degrees.

If n is multiplied by $\sqrt{-1} \times \sqrt{-1}$, the same result is produced as before. Therefore, the result of $nx\sqrt{-1}$ must give rise to a rotation of 90 degrees only and the line representing n becomes vertical. The full rotation of

180 degrees may be regarded as a rotation in two stages of 90 degrees each.

If n is multiplied by $(\sqrt{-1})^4$, the result is again $-n$ and the rotation may be regarded as having been effected in four steps of $180/4 = 45$ degrees.

This conception of j as a rotating operator is of the utmost importance

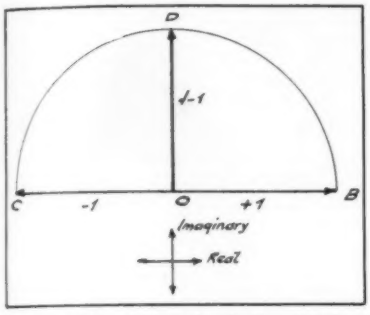

Fig. 27. Axis of "Imaginaries" and Axis of "Reals."

in alternating current problems and the subject will be returned to later on.

The Powers of j

$j = j$ $\quad j^5 = j \times j^4 = j$

$j^2 = -1$ $\quad j^6 = j^2 \times j^4 = j^2 = -1$

$j^3 = j \times j^2 = -j$ $\quad j^7 = j^3 \times j^4 = j^3 = -j$

$j^4 = (j^2)^2 = 1$ $\quad j^8 = j^4 \times j^4 = j^4 = 1$

$j^9 = j \times j^8 = j$

$j^{10} = j^2 \times j^8 = j^2 = -1$

$j^{11} = j^3 \times j^8 = j^3 = -j$

$j^{12} = j^4 \times j^8 = j^4 = 1$

The first four powers of j give j, -1, $-j$, and 1. The next four powers give the same result and so do the next group. Any four integral powers of j will give ± 1 when the power is even and $\pm j$ when the power is odd.

Negative powers of j:

$j^{-1} = 1/j = j/j^2 = j/-1 = -j$

$j^{-2} = 1/j^2 = j/-1 = -1$

$j^{-3} = 1/j^3 = 1/-j = j/-j^2 = j$

$j^{-4} = i/j^4 = 1/1 = 1$

$j^{-5} = j^{-1} \times j^{-4} = j^{-1} = -j$

$j^{-6} = j^{-2} \times j^{-4} = j^{-2} = -1$

$j^{-7} = j^{-3} \times j^{-4} = j^{-3} = j$

$j^{-8} = j^{-4} \times j^{-4} = j^{-4} = 1$

The negative integral powers of j give ± 1 when the power is even and $\pm j$ when the power is odd.

An Algebraic Aid to Arithmetic

Simple algebra frequently aids an arithmetical process. An example of this is furnished by the explanation of the ordinary artihmetical process for the extraction of the square root.

The logarithmic method for extraction of the square root of a number is immeasurably superior to the arithmetical process, but if no table of logs., slide rule, or other calculating appliance, is available it is advisable to be able to employ the arithmetical means and this involves the necessity for understanding it.

Suppose it is required to find the square root of 73. By inspection this will lie between 8 and 9, say $8 + x$. Then,

$$73 = (8 + x)^2$$
$$= 8^2 + 2(8x) + x^2$$
$$= 64 + 16x + x^2$$

Subtracting 64 from both sides,

$$9 = 16x + x^2.$$

Therefore, neglecting x^2, $x = 9/16$ as a first approximation, and the root of 73 is thus $8 + 9/16 = 8.5625$ approximately. x is actually a little less than 9/16 and the correct result would be 8.543.

Example 2: Find the square root of 168.

Write it $13 - x$. Then,

$168 = (13 - x)^2 = 169 - 26x + x^2$.

Neglecting x^2

$$-1 = -26x \text{ and,}$$
$$x = 1/26 = 0.0384$$

Therefore, $\sqrt{168} = 13 - 0.0384 = 12.9616$, approximately.

Example 3: Find the square root of 398. Let it be $20 - x$.

$$398 = 400 - 40x + x^2.$$
$$-2 = -40x \text{ and } x = 0.05$$

Therefore, $\sqrt{398} = 19.95$, which corresponds exactly to the true figure.

Example 4:

$$\sqrt{1{,}000{,}021} = \sqrt{10^6 + 21}$$

Call this $10^3 + x$. Then,

$(10^3 + x^2) = 10^6 + 2000x + x^2$ whence

$$x = 21/2000.$$

Therefore, $\sqrt{1{,}000{,}021} = 1000.00105$.

It will be noted that the additional quantity is very small and, further, that it is exactly half the value of the corresponding quantity in the square. Thus,

$$(10^3 + x)^2 = (10^3 + 15/1000)^2 =$$
$$(10^3 + 0.015)^2 = 10^6 + 0.0075.$$

This is a binomial approximation frequently used which results from neglecting x^2 and putting $(1+x)^2 = 1 + 2x$ when x is negligibly small. Therefore, $\sqrt{1 + 2x} = 1 + x$ approximately.

Thus

$$\sqrt{(1.006)} = 1.003$$
$$\sqrt{(100.066)} = \sqrt{100(1.00066)}$$
$$= 10 \times \sqrt{(1.00066)}$$
$$= 10 \times (1.00033)$$
$$= 10.0033 \text{ approximately or}$$
$$\sqrt{(1 + x)} = 1 + x/2 \text{ approximately}$$

The approximation can manifestly be applied most easily to numbers separable into two very unequal portions, one of which has a known square root. Where they are not very unequal, neglect of x^2 has some effect and the approximation process must be continued before the square of the remainder becomes negligible.

Example: Find the square root of 79 by successive approximation.

Write $79 = (8 + x)^2 = 8^2 + 16x + x^2$

$$= 64 + 16x + x^2.$$

Therefore, $15 = 16x + x^2$.

$$x = 15/16 = 0.9375.$$

The first approximation is, therefore,

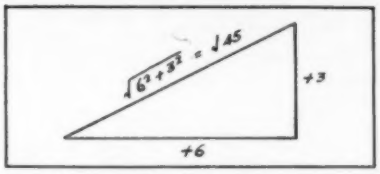

Fig. 28. Graphic Representation of a Complex Quantity.

8.9375. Using the value thus obtained, write

$$79 = (8.9375 + x)^2$$
$$= 79.87 + 159.74x + x^2$$
$$-0.87 = 159.74x$$
$$x = -0.00549$$

The second approximation is, therefore, $8.9375 - 0.00549 = 8.932$.

Repeating the process,

$79 = (8.932 + x)^2 = 79.8 + 159.6x + x^2$

$$-0.8 = 159.6x$$
$$x = -0.8/159.6 =$$
$$-0.005012$$

Third approximation $= 8.932 - 0.005 = 8.927$.

The process could be continued indefinitely but x is now so small that its square can be neglected.

It is now possible to understand the basis of the arithmetical process for the extraction of the square root of a number. Any number whatever, say N, can be split up into two parts $(a + x)$. $N^2 = a^2 + 2ax + x^2$.

Suppose that it is required to find the square root of 6241. As $(70)^2 = 4900$ and $(80)^2 = 6400$, the square root of 6241 will lie between 70 and 80 and $6241 = (a + x)^2 = (70 + x)^2$.

Set down 6241 and draw a vertical line at the right, thus:

6241	70
4900	
1341	

Put down 70 to the right of the vertical line, square it and subtract the result from 6241. The remainder, 1341, is obviously equal to $2ax + x^2$. Multiply 70 by 2, which gives $2a = 140$; 140 should now be divided into 1341 when it will give x. 140 goes into 1341 9 times and $9^2 + 9 \times 140 = 1341$.

The result will now stand,

6241	70	$= a$
4900		$a + x = 70 + 9$
1341	9	$= x$

$2a = 140$

$x = 9$

$2a + x = 149$

$149 \times 9 = 1341$

and $\sqrt{(6241)} = 79$.

Find the square root of 21,904.

First divide the number into periods of two figures, marking to the left from the unit's figures. Thus: 21,904.

The object of this division is to ascertain how many figures there will be in

the root and also what figures should be operated on to obtain a.

The reason for this operation will be gathered by reference to the following:

$$10 \times 10 = 100$$

$$100 \times 100 = 10000$$

$$1000 \times 1000 = 1000000$$

If the square root has two, three or four figures, there are two, three, or four periods in its square. In the number whose square root is to be extracted there are three periods. The root will, therefore, have three figures and will lie between 100 and 999.

	21904	148
	1	
2	119	
$(20 + 4) \times 4$	96	
$(280 + 8) \times 8$	2304	
	2304	
	....	

Setting down the number as in the foregoing and pointing off, the procedure is as follows:

Find what number will give a square equal to or less than the first period (2). This is 1. Set this to the right of the vertical dividing line. Since there are three figures in the root and the first one is 1, it clearly represents 100 but there is no necessity to write the ciphers. Subtract 1 from the 2 and affix the second period, 19, to the remainder.

Now multiply 1 by 2 and divide 11 by the result. It goes 5 times but $(20 + 5) \times 5$ exceeds 119. Try 4. $(20 + 4) \times 4 = 96$, and this subtracted from 119 leaves 23 to which the last period is affixed. Multiply 14, the partial answer by 2 and see how often 28 goes into 230. This will be found to be 8 and, since the divisor increases ten times at each stage, the final divisor will be $280 + 8$ which divides into 2304 exactly 8 times, giving 148 as the square root of 21,904.

The procedure is exactly the same for a mixed number such as 132.13225. Care must be taken in pointing and in the case of the decimal portion this commences from the second figure after the decimal point. Thus, 132.13225.

[AUTHOR'S NOTE: Two slight errors crept into the first and second instalments of this series. In the first column of page 9 of the instalment published May 30 the expression $\sqrt{32} = 10^{-4}$ should have read $\sqrt{32} \times \sqrt{10^{-4}}$. In the second column of page 9 of the second instalment, published June 27, the equation, $b = \sqrt{a \times d}$ should have read $b = \sqrt{\overline{a \times d}}$.]

M. L. Golladay Dead

MAURICE L. GOLLADAY, prominent in Independent telephone circles for a third of a century, during which time he was identified with the Holden (Mo.) Home Telephone Co., its successor, the Middle States Utilities Co., and the Johnson County Telephone Co., of Warrensburg, Mo., passed away August 17, at his home in Holden, Mo.

Thus ended an exceedingly busy and useful life, spent almost entirely in the city which marked his birth, September 9, 1870. The only son of David and Maria Lawrence Golladay, prominently identified with the early development of Holden, Maurice L. Golladay received his scholastic education in the local schools and the Wentworth Military Academy at Lexington.

Entering his father's drugstore, he learned the drug profession and was a graduate pharmacist. He later became interested in electrical communication and in 1900, with two associates, organized the Holden Home Telephone Co., serving as secretary and general manager. From a small beginning, the company experienced a steady growth, serving 1,500 subscribers in 1924 as compared with 560 in 1907.

Controlling interest in the Johnson County Telephone Co., of Warrensburg, Mo., with some 2,600 telephones was acquired by Mr. Golladay in 1924. As secretary and general manager, he assumed charge of the operation of the properties, in addition to continuing his duties with the Holden Home company.

In 1926, when Mr. Golladay sold the Holden telephone system to John A. Reed, of Cedar Rapids, Iowa, it included the territory from Strassburg, in Cass county, to LaMonte, in Pettis county. The company became known as the Central Missouri Home Telephone Co. Including this group of exchanges Mr. Reed incorporated some 75 exchanges in northern Missouri and southern Iowa under the name of the Middle States Utilities Co. In addition to retaining his connection as general manager of the Central Missouri company, Mr. Golladay also served as general manager of the Middle States company until 1931.

In addition to giving his home city its first telephone system, Mr. Golladay also developed the Holden Ice & Fuel Co., which was sold to the Community Ice Co., in 1929, the Holden Steam Laundry, the Home Oil Co., the Hillcroft Farms, consisting of 160 acres of land located north of Holden. He was president of the Golladay Investment Co., the Golladay Motor Co., the Warrensburg Motor Co. and chairman of the board of directors of the Bank of Holden. He organized the Holden Chamber of Commerce, of which he was president at the time of his death.

Mr. Golladay had been in ill health for the past few years and spent the winters in California, with his wife, in the hopes of benefiting his health. Upon returning to Holden last spring he made arrangements for building a new gasoline filling station, to be known as the Skelley Oil Station and to represent the last word in modern equipment. While inspecting the new building, scheduled to be opened last week, Mr. Golladay was stricken with a heart attack, which ended in his death four days later.

One of the organizers of the Missouri Telephone Association, Mr. Golladay enjoyed an honorary life membership. He was actively engaged in the work of the association for many years, serving as president as well as director. At the 1935 convention of the association, he presented a very interesting paper in which he related some of his experiences in the early days of Independent telephony. This was published in TELEPHONY of February 29, 1936, under the title "Rambling Reminiscences of a Has-Been."

He was a 32nd degree Mason, a member of the Ararat Shrine in Kansas City, the Odd Fellows, Elks, and Woodman of the World. He was also a member of the Independent Pioneer Telephone Association of the United States.

IN THE NATION'S CAPITAL

By FRANCIS X. WELCH,
Special Washington Correspondent for TELEPHONY

THAT THE Federal Communications Commission is churning with conflicting cross-currents is not news. Judging from past performance, it has become almost the normal state of affairs within the commission. Internal dissension reached a new high, however, with the recent reports of a drastic shake-up in the FCC's investigating staff (TELEPHONY of August 22).

Two Washington newspaper men, representing different journals, got wind of the story and the news was accordingly printed in the Hearst papers and New York financial papers. Two days later commission officials stoutly denied that Special Counsel Samuel Becker, Chief Accountant John Bickley, or any other key men would be relieved of duties from the special telephone investigating staff.

What is behind all this? The answer is—the same old stuff. Members within the commission who want to sidetrack Messrs. Bickley, Becker and a few others—and they have been wanting to do it for a long time—finally decided to force the issue. Before it happened, however, the newspapers spread the word and panic seized the New Dealers, who want to preserve an outward appearance of peace and serenity in all New Deal bureaus, at least for the duration of the campaign.

This correspondent doubts very much if those who are out for the respective scalps of Messrs. Bickley and Becker can long be delayed, but for the present they are stymied. It is only a temporary stay, however. Make no mistake about that.

REGARDLESS of the exact degree of accuracy, press reports of a contemplated shake-up in the special telephone investigating staff of the Federal Communications Commission should not be a surprise to regular readers of this department. What may cause a surprise, however, is the current gossip to the effect that congressmen were disgusted with the "unfair tactics" of the commission in handling this probe.

It may not strike folks who do not follow capital capers very closely as strange, but to a Washington observer with any recent experience at all, the suggestion that congressmen are objecting in large numbers to an administrative body persecuting big business seems about as amusing and unlikely as a Malay coal-passer objecting to the table manners of a Filipino mess boy.

BY AND LARGE, it has usually been Congress, and particularly committees of Congress, rather than administrative agencies, which have led the way in trust-busting, business-baiting, and other conduct designed to stir up class animosity. In any event, it has been a long time since any member of Congress—even arch-conservatives such as Republican Senator Hastings of Delaware, or Democratic Senator Glass of Virginia—has publicly let it be known that he was acting in any specific instance for the exclusive protection of large corporate enterprise.

Frequently such conservatives have, with sincere convictions as to the ultimate benefit to general public interest, acted indirectly to curb radical anti-business measures, but they have done such things very quietly indeed. It would defeat their purpose and possibly their future candidacies to do otherwise.

In truth, if one will be really fair and broadminded, the so-called power of big business is just about the weakest sort of power here in Washington. It has its lobbies, of course, but as previously observed in this department, big business lobbies have, since the New Deal at least, functioned principally in self-defense—handing out counter-propaganda in the hope of curbing the sallies made by the progressives.

It is the liberal and so-called "mass" lobby that wins the important legislative votes. The veterans' bonus, social security, railroad retirement, the Guffey coal bill, the labor relations board—these are all victories won for the popular lobby groups.

But when was the last time the "malefactors of great wealth" put over anything in Washington? Indeed, it has been a long time since they have been able to hold their own. Take the so-called power trust, for example, which West Virginia's boy Senator, Rush Holt, assures us "dominates and controls the entire Federal Government." They fought the TVA and lost. They fought Grand Coulee—and lost.

They fought, with great fury, the holding company bill—and lost. Before Roosevelt's time—before even Hoover's time—they fought the proposal to investigate them, the proposal that finally ended up with the Federal Trade Commission. They lost, of course. They always lose.

Even the slim margin of defeat on the St. Lawrence Treaty in 1934 was the result of port jealousy between Eastern seaboard Senators (Copeland, Tydings, Long, etc.) and the Middle Western group. If power alone were the issue, the treaty would have been swamped with support.

This correspondent can recall the temporary victory that the electric industry enjoyed when the "death sentence" section of the holding company act was defeated in the House of Representatives. (Subsequently, the House yielded to presidential pressure.) He had just returned to Washington from a short trip and was riding in a taxicab from the Union Station.

"Well," chatted the cab driver amiably, "I see where the power trust put over a victory in Congress yesterday."

"It seems that way," was the cautious reply.

"You know," said the cabby "I was rather glad to see it. It seems like the big business people never seem to get a break any more. I'm against them, you understand, the whole kit and caboodle of them, but I do like to see them show a little fight now and then. They ought to take a trick, at least every so often, to kind of hold their franchise or something."

COMING BACK to the telephone probe, one wonders, therefore, just what has come over congressmen that, in this day and age, they even dare sign their names to letters objecting to an administrative agency engaged in the mere routine of beating big business over the head with a blackjack.

The problem seems to be puzzling a number of Washington newspaper men. A good many of them do not believe that congressmen have objected, in large numbers, at least, to the FCC's handling of the Bell investigation. They are certain that press reports to that effect are based on inaccurate information.

The matter was discussed by a small luncheon group at the National Press Club recently, and nearly half of the scribes on hand scouted the theory that congressmen had rushed to the aid of the telephone industry. They agreed that congressmen may have kicked about the FCC; they have done that frequently in the past, but their objections to the FCC, however strong, have heretofore been on other grounds than alleged unfairness to big business.

Someone raised the question of whether congressmen had been influenced by their own holdings in telephone securities. After all, A. T. & T. stock is the most widely-distributed security in the world and it is likely that well over half the members of Congress, or members of their families, have some sort of Bell security tucked away in their portfolios. Such a supposition, however, seems to this correspondent to cast an unfair reflection upon the sincerity of our congressmen.

Most of them hold other corporate securities as well, but it has not hindered them from belaboring big business unmercifully for the last three years. Take the outstanding example of President Roosevelt, whose family is possibly the principal stockholding interest in the General Electric Co. of Schenectady. As we all know, this did not hinder the President from cracking down upon the electric utility industry that must provide the bread and butter for General Electric.

Multimillionaire Senator Couzens of Michigan is another outstanding example of a prominent political figure who does not let his stockholdings interfere with his political convictions about business reforms. You will find that most congressmen are just about the same.

AND STILL the question is unanswered. Why did the congressmen squawk about the FCC's investigation—if they did squawk? Well, first of all this correspondent knows, personally, of at least three members of Congress—one a Senator—who certainly did complain, and in no uncertain terms, about the FCC's telephone investigation. They complained directly to the White House. Others took more circuitous routes, via Democratic Chairman Farley, via Vice President Garner, etc.

One Representative of Congress—incidentally a member of the very subcommittee that passed last spring upon the FCC's application for more funds for its Bell probe—told this correspondent that he considered the FCC's conduct of the Bell investigation "a piece of childish exhibitionism." The FCC will never get another nickel for its investigation so far as he is concerned.

The only reason why these members of Congress have been moved to complain about the FCC probe is the principal reason why congressmen are moved to do anything—pressure from constituents.

As previously stated, A. T. & T. stock is the most widely held of any corporate security in the world. There is your answer, and it is a tribute to the customer-ownership activity of the telephone industry generally. Certainly the electric utility industry, whose stocks are also widely held, does not command sufficient organized customer-owner support to escape political persecution—nor the steel industry, nor chemicals, nor railroads. No other industry could have done it.

In a way it is a stinging refutation of the implication of recent FCC testimony at the probe to the effect that telephone shares are for the most part concentrated among a few large holders. The FCC knows differently now.

The situation tends to prove the wisdom of customer-ownership. It even indicates that in a popular democracy, customer-ownership may be the only effective cushion or bulwark that a large and important industry can possess against the possible political reprisals.

THERE WERE, of course, a number of reasons for dissatisfaction with the special telephone investigation, other than disapproval of individual congressmen. Standing out more than anything else was the internal dissension caused by the importation of an important investigator from Wisconsin.

There is nothing wrong with Wisconsin—far from it. But the fact that Chief Accountant John A. Bickley—once installed as the dominating figure of the investigation—used his influence to have others of his former associates on the Wisconsin commission brought to Washington, caused inescapable jealousy, especially among friends of employes who were released to make room for the new arrivals. This correspondent has heard, over at the FCC itself (as distinguished from the investigating staff headquarters), somewhat slighting reference to the "Wisconsin clique," and the "Wisconsin Commission Alumni Club."

Possibly this resentment of the Wisconsin avalanche is unfair, but there it is—take it or leave it. Inevitably it had the effect of spreading to congressmen and political chieftains outside of the FCC who were responsible for or interested in some patronage inside of the FCC. Undoubtedly it spread to members of the commission itself who are too frequently at odds with one another on other matters to ignore such prime grounds for argument.

Be that as it may, it is only the beginning, folks, as the radio chap says, it's only the beginning. After the election (and regardless of its outcome) the long overdue shake-up of the commission itself will take place, if indeed the board manages to hold together even that long.

Of course, it is perfectly obvious that until the election is over, the more practical Democratic chieftains will do everything possible to make it appear that every creature of the New Deal is functioning perfectly. It would not do to have to admit during the campaign that the FCC probe is a flop or a false alarm, or that it got off to a miserable start. Hence Commissioner Walker's somewhat shaky protestation that all is quiet along the Potomac.

▼ ▼

Fire! No Telephones; Drive for Help

The story of a disastrous fire on the farm of Ralph Scearcy, near Winnebago, Minn., was related in a recent issue of the Bricelyn (Minn.) Sentinel. These few sentences explain why the fire proved so destructive:

"Mr. Scearcy, who was partially dressed, ran to the barn to get the calves and pigs out. He was driven back by the intense heat and flames. He got into his car and drove to the home of a neighbor to telephone the alarm to the Amboy fire department. . . ."

A loss in time of even a few minutes is a serious thing when it comes to fighting a fire. As a result, no doubt, of the failure of this farmer to maintain a telephone in his own home, his farm buildings (including a large barn and machine shed, two corn cribs, a large chicken house, garage, tool house and milk house), were completely destroyed. In addition, he suffered a heavy loss in machinery and farm equipment, also chickens, two calves and five pigs.

Another page of the same issue of the Bricelyn Sentinel tells a similar story of the complete destruction of the farm home of Everette Johnson, with all of his household goods. Having no telephone in his home, the newspaper story says that "Mr. Johnson drove to a neighbor for help."

Duties of Operator in Small Town

By MARJORIE BECKEL
Operator, Central States Electric Co., Vincent, Iowa

A SMALL exchange operator performs innumerable duties in her everyday work—answering calls, keeping the books and records, billing subscribers, accepting trouble reports and keeping switchboard and office clean—and still finds time to be friendly to the company's customers and endeavor to increase the subscriber list. She often takes place of doctor's office girl. Address before operators' conference of a district meeting held last fall at Fort Dodge, Iowa

IT WAS ON a Wednesday morning. The sun was shining brightly. The atmosphere was cool and the birds were singing in the treetops as I was walking along on my way to the office to resume my duties as day operator at the switchboard after a three-weeks' vacation. Although I had had a wonderful time and had enjoyed every minute of it, I was delighted to think I was going back to my work—to hear the voices of our subscribers calling in, to give them the best of service and to please them in every way I could.

As I walked into the office that beautiful morning, I was greeted by the operator seated before the switchboard, with a smile on her face, ready to answer all calls coming in and anxious to please every subscriber. After a brief conversation with her, in the course of which she told me of the new business added, of the collections that were made and a few other interesting incidents that had occurred during my absence, I again took my place at the switchboard to begin my daily tasks.

When I had entered the telephone company's service as operator, I thought my only duty was to make connections for local and long distance calls. After a few years' experience, however, I found that operating the switchboard was only a part of the duties of a good operator.

In our office, I keep a complete set of books. I also keep a daily record of all outgoing toll calls and I post all previous toll tickets in this book every morning. The time spent in keeping a record of those toll tickets has repaid me many times and saved me many a worry, for in case one or more toll tickets have been misplaced and our toll statements do not check, we have our record book to refer back to.

Marjorie Beckel, Operator at the Vincent, Iowa, Telephone Exchange of the Central States Electric Co.

On the 22nd of each month, I make out all toll statements and a toll report is sent in to the division office. On the 25th of the month we collect all unpaid tolls and rentals from business and residence subscribers in town and a general line call is given for the benefit of rural subscribers whose bills are unpaid. On the last day of each month I make out and mail all toll and delinquent rental statements.

Practically every complaint made by a subscriber regarding his bill or concerning his toll statement is that he thinks he has been overcharged or is the result of a misunderstanding. The operator should explain to the complaining subscriber the classification of toll calls, the differences in rates. She should tell him the dates on which the toll calls were made, by whom they were made and the number of minutes taken up by the conversation.

Every effort should be made to keep a customer satisfied. I do not mean that in order to satisfy a customer the operator should give rebates or cut the time short on toll calls. An incident which occurred in my own office a short time ago will illustrate what I mean.

An out-of-town subscriber came into the office and placed a station-to-station call over long distance. When the call was answered by the particular station called, my party asked for a certain person with whom he wished to speak. When he got this party on the line, he took out his watch and started to time the call himself. It happened, however, that hardly three minutes passed from the time the receiver was taken off until it was placed back on the hook.

At first the subscriber did not realize that the time was going on from the moment when the telephone was first answered. After I had explained to him the difference between a station-to-station call and a person-to-person call—how the tickets were timed by a

timing clock—he realized the mistake he had made. He remarked that no one had ever explained it to him in any way, and he had reached the conclusion that he was being overcharged. As a result of my explanation, he went away a very much satisfied customer.

We should try to make the subscriber's trip to the telephone office a friendly and educational visit, making it a pleasure for subscribers to pay their bills. Through lack of understanding of our classifications and rates a subscriber often thinks we do not attend to our duties and that he has been neglected. As a result he has formed an unfavorable opinion of the company and its employes. It may not reflect upon the operator as much as it does upon the company, and sometimes it may cost us a subscriber.

The operator should keep in mind that she is first a servant of the subscriber and then an employe of the company. The individual, whether he is a subscriber or not, should be treated with every courtesy and his troubles or requests regarded as being of utmost importance. We know that the average subscriber to telephone service is potentially a lifetime customer.

Operator Helps to Detect Service Dissatisfaction

In a small exchange the operator is also the trouble clerk. In our exchange trouble tickets are made out each time a case of trouble is reported. Any information which would aid the lineman in clearing the trouble is put on the ticket. Many a case of trouble can be detected by an operator while listening to the subscriber calling his number. She gains the impression, either from the tone of his voice or the words employed that he is annoyed about some phase of the telephone service.

Perhaps the telephone needs new batteries or the telephone cuts off, or there is some other service difficulty. In such instances the operator should make out a trouble ticket and report it to the lineman. As a result the trouble is oftentimes attended to before the subscriber makes a complaint.

Another duty of the operator as trouble clerk is to see that the switchboard receives proper care. Dust accumulating on any part of the switchboard and allowed to remain there will hinder the mechanical efficiency of the board. The switchboard plugs should be cleaned and polished every few days. This will greatly improve the appearance of the switchboard as well as enabling better connections to be made.

An operator should be neat in appearance and becomingly dressed. She should keep her office as attractive as possible. She should sit erect in her chair, with her mind and body intent upon the work at hand. She should not permit her thoughts to stray to other things and be mentally asleep on the job.

Since our company has four exchanges and we do not have a permanent lineman in each town, after a terrific electrical storm it is necessary that such work as replacing burned-out fuses be done by the operator. This saves the lineman a trip for that purpose, reducing maintenance costs, and gives the subscriber more efficient and continuous service.

Operator Serves as an Information Bureau

In small exchanges the operator also serves as an information bureau, giving out such information as time of day, the date and location of community gatherings or lectures, information concerning a sick friend, etc. Sometimes the operator is asked to give out information on personal matters, but she has to refuse, in a courteous way, to give out such information.

The operator also takes the place of a doctor's office girl. When a doctor makes a visit, he telephones the operator and tells her where he is going and when he will be back. Thus if he should be called on an emergency case, the operator can always locate him. This applies to a veterinary as well as an M. D. Oftentimes the operator is personally rewarded for her service to these professional men.

In a small exchange, when a fire is reported to the operator, she gives a general call on all rural lines and also calls places of business in town where men are accustomed to congregate. She is sometimes asked to give a line call when a fire has originated in a neighboring town.

Another very important duty of the operator in a small exchange is to get back the business the company has lost during the depression. It is the practice of our company to furnish a relief operator and pay the expenses of the operator in her work of soliciting new business.

In selling this service, the operator must use tact. She should greet the company's prospects with a smile and show a sincere desire to help them in the solution of their problems. By being patient and tactful we may add materially to the profits of our company.

Do not concentrate on one particular person. It is always best to spend a short time with each of your non-subscribers. While soliciting this new business we oftentimes stop at a subscriber's home for just a friendly call. Sometimes information that we receive on these calls is very beneficial in getting new business.

An Alert Operator May Secure New Subscribers

An operator also has an opportunity to get new business when a non-subscriber calls at the office to place a call. She must be very careful not to offend a prospective subscriber. It is a good practice to be no less courteous and considerate in the office than in the home. Oftentimes the manner in which one speaks will make or lose a business friend.

The duties and services of an operator in a small exchange are as important and beneficial to the community for which she works as any professional service that ever was rendered. If I, as an operator, could not give the community and the company for which I work the loyalty and efficient service that they should have, I should think it was time another operator took my place.

Pleasing the public and the company with accurate, prompt, courteous and dependable service should be the slogan of every operator.

COMING CONVENTIONS

Telephone Association of New Hampshire, Hotel Ashworth, Hampton Beach, N. H., September 9 and 10.

The Illinois Telephone Association, Pere Marquette Hotel, Peoria, September 17 and 18.

Telephone and Telegraph Section, Association of American Railroads, Mayflower Hotel, Washington, D. C., October 6, 7 and 8.

United States Independent Telephone Association, Hotel Stevens, Chicago, October 13, 14, 15 and 16.

Independent Pioneer Telephone Association of the United States, Hotel Stevens, Chicago, October 15.

Indiana Telephone Association, Claypool Hotel, Indianapolis, May 11 and 12, 1937.

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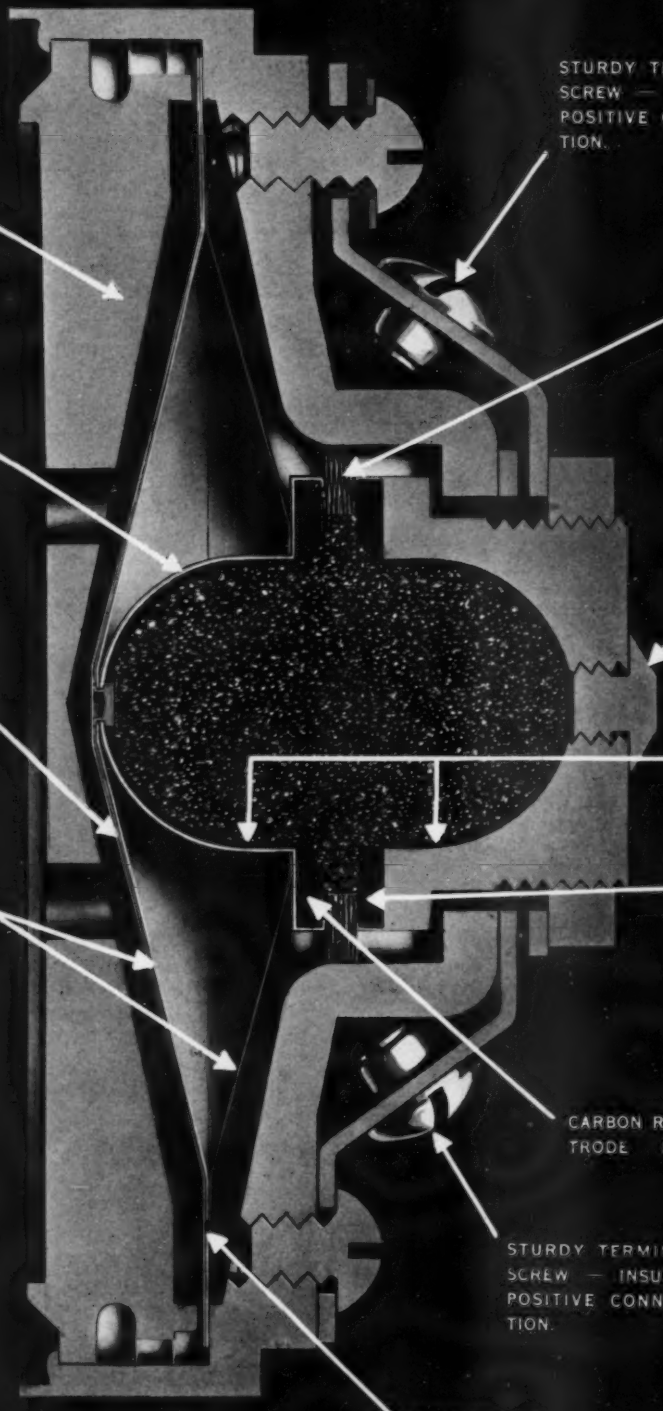

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The artificial "mouth and ear," used by Automatic Electric engineers to measure comparative transmitter responses with scientific accuracy.

THAT THE TYPE 35A7 TRANSMITTER HAS TRUE "ALL POSITIONS" PERFORMANCE

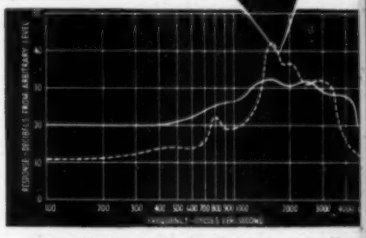
In developing the Type 35A7 "All-Positions" Transmitter, Automatic Electric engineers enlisted the aid of the most up-to-date laboratory equipment known to acoustic science, to supplement the customary "talk and listen" tests. The mechanical "mouth and ear" shown at the right is typical of the precision apparatus they used. Armed with this modern equipment, they were able to measure transmitter response with scientific accuracy.

In the course of their studies, they made exhaustive tests of every type and shape of electrode—every type of carbon cell design. They found that only the combination used on the Type 35A7 transmitter gave completely satisfactory performance under all conditions, and throughout the "all-positions" cycle. The curves at the right show the results of some of their tests on the final product.

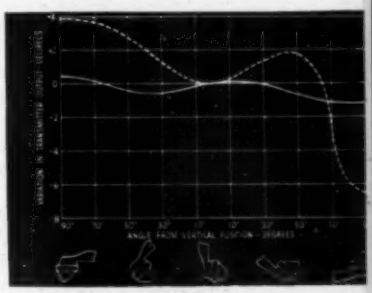
The secret of this remarkable "all-positions" performance is in the ring-shaped electrodes and spherical, insulated carbon chamber—an exclusive Automatic Electric development found only in the Type 35A7 transmitter. Here is a summary of the principal advantages it offers:

1. Uniform response regardless of position held.
2. High fidelity with no sacrifice of volume.
3. Unaffected by humidity, temperature or pressure.
4. Longer service life without deterioration.
5. Sensitivity does not change either gradually or periodically.

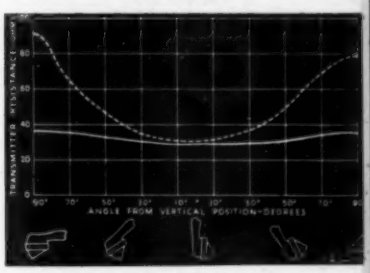
The Type 35A7 transmitter is now standard equipment on all Monophones, and is interchangeable with transmitters of all existing Monophones. It represents one reason — and not the least of them — why Monophone sales are mounting so rapidly. Prices and full details on request.



The solid line shows the higher, more uniform response of the 35A7 transmitter, as compared with that of the previous Monophone transmitter.



The solid line in this graph shows the almost constant output of the new transmitter throughout the complete cycle of positions.



These curves show the comparative resistance of the new and old transmitters (solid and dotted lines respectively) throughout the "all position" cycle.

AUTOMATIC ELECTRIC

TELEPHONE, COMMUNICATION AND SIGNALING PRODUCTS

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Export Distributors: AUTOMATIC ELECTRIC SALES COMPANY, LTD., Chicago

Order in Iowa Power Case Protects Communication Companies

TEMPORARY RULING just handed down by Iowa Railroad Commission on application of power company for authority to install multiple grounds on primary neutral wires. Permission is granted for use of this type of construction for two years, pending final decision by the commission, provided petitioner complies with order of December 30, 1916, and makes financial settlement with communication companies whose circuits will be exposed to interference, before starting construction

AUTHORITY to install multiple grounds on the primary neutral of single and/or three-phase star or "Y" connected electrical supply systems at a voltage suitable for rural electrical service was granted to the Citizens Power & Light Co., of Council Bluffs, Iowa, in an order issued August 18 by the Iowa Railroad Commission. It is for a temporary period of two years and is conditioned upon the protection of communication lines as provided in the commission's order of December 30, 1916, covering electrical interference between transmission, telephone and telegraph lines.

The company is ordered to negotiate with the communication companies whose circuits will be exposed on the same highway to the proposed power circuits, to the effect that it will comply with the order previously mentioned, in making ground return telephone circuits metallic and solving other inductive coordination problems involved, and that the financial settlement will be made with the communication companies before the construction of such power circuits is started.

The commission states, in its findings, that it is the opinion that the data available on the subject of inductive influence of wye-connected, multi-grounded primary neutral rural power distribution circuits on communication circuits, both metallic and ground return, is not conclusive. Additional information should be made available, it continues for further consideration before it will issue a final order in this docket.

In the meantime, the commission will consider approving the installation of similar construction by other power companies so that additional information may become available, provided similar steps are taken for the protection of communication lines thus affected as are required of the petitioner in the instant case.

The order reads, in part, as follows:

"The Citizens Power & Light Co., Council Bluffs, Iowa, is authorized to reconstruct its wye-connected rural power distribution circuits in Mills and Pottawattamie counties, Iowa, and install multiple ground connections on the neutral wire of said distribution circuits, providing that an agreement is made as to the settlement of inductive coordination problems involved with communication companies operating communication circuits exposed at highway separation to the power distribution circuits of said Citizens Power & Light Co.;" . . .

It is further ordered, that in the event the companies proposing to install wye-connected, multi-grounded primary neutral rural power distribution circuits and communication companies, whose circuits will be exposed at roadway separation to the proposed power circuits, cannot complete negotiations as to the financial settlement of the amount involved in making ground return telephone circuits metallic and other inductive coordination problems involved, this matter may be referred to the Board of Railroad Commissioners for final disposition, and the financial settlement shall be made with the communication companies before starting construction of the power circuits."

History of Case

The application in this proceeding was filed with the Iowa Railroad Commission April 16, 1935. After a public hearing, on May 21 of that year, the commission, on June 5, 1935, ordered the Citizens Power & Light Co. to install for test purposes additional ground connections on the neutral wire of its wye-connected, rural power distribution circuits, so that the electrical supply and communication companies might make a joint study and investigation to determine the inductive influence of such distribution circuits on exposed communication circuits at roadway separation.

After the investigation had been made a technical report, dated February 26, 1936, and signed by T. A. Taylor, of the Bell Telephone Laboratories, and H. W. Wahlquist, for the Edison Electrician Institute was filed with the commission. After another hearing on the subject, July 21, 1936, upon the recommendation of the joint general committee, which directed the investigation but which did not come to an agreement as to what recommendation should be made to the commissioners, the Iowa Railroad Commission was of the opinion, as stated in the findings of its order of August 18, that the data available is not conclusive and that additional information be made available before the issuance of a final order in this docket.

The Iowa Independent Telephone Association has vigorously opposed the granting of permission to electric companies to use construction of the type in which the primary neutral wire is multi-grounded. It was represented at the hearings in this case by C. E. Cowherd, attorney of Kansas City, Mo.; Chas. C. Deering, secretary-treasurer, of Des Moines; and J. W. Wopat, consulting engineer, of Fort Wayne, Ind.

Representatives of nearly a dozen Independent telephone companies also

attended the hearings, as did representatives of the Bell Telephone System, the Bell Telephone Laboratories, the Western Union Telegraph Co., the Association of American Railroads, a number of railroad companies and four power companies, in addition to the applicant. The latter was represented by its attorney, Rex H. Fowler, of Des Moines, F. E. Smith, chief engineer, of Omaha, and J. O. R. Coleman, engineer, of New York City.

In a letter to its member companies, enclosing copies of the temporary decision in the Iowa multi-grounding case, the officers of the Iowa Independent Telephone Association caution them "to exercise great care in dealing with electric cooperatives, to see that your rights are protected, and that their estimates to the REA contain proper amounts to reimburse you for all expenses for which they are legally liable to you; that otherwise you may have a perfectly legal claim and be unable to collect."

The Operators' Corner

By MRS. MAYME WORKMAN

Traffic Supervisor, The Illinois Telephone Association, Springfield, Ill.

TO EMPLOY or not to employ married women. Question has been problem to all employers during the past several years. Series No. 255

A QUESTION of interest to all employers for the past several years has been whether "to hire or not to hire married women." This question was brought about through a shortage in employment.

Telephone companies, employing many women, were faced with this problem. While they did not adopt a uniform practice regarding the situation, every company made a conscientious effort to solve this question, considering not only the service to the customer but also the employe's welfare.

Some companies refused to hire married women but retained those who were already employed; other companies asked their married women to resign at a specified time; in other companies, if a girl married it meant she must resign in two weeks; again, some companies attempted to retain married women who were in dire need of work.

Among our questions this week some one has asked: "Which makes the best operator, married or single women?" This is a question which might well be referred to a Solomon, as it has so many angles.

The first thought that comes to the writer's mind is that it will be the girl who is best fitted for the job—the girl who finds real pleasure in her work and puts forth her best effort, not merely for her weekly pay check, but also for the satisfaction she derives in her position of being of service to others.

Unquestionably the status of the employe does enter into the situation, from either the married woman's or the single girl's standpoint. Let us review the average single girl's viewpoint on the employment of married women:

"Why should the company employ married women? They have husbands to keep them and are taking jobs away from single girls who need them!"

And the married woman will probably say something like this:

"This is a free country and I have a perfect right to work if I am qualified for the job!"

In some instances they are both right while in others they are both wrong.

Thousands of single girls are working today because they are dependent upon their own efforts to earn a livelihood. Others are working in preference to helping their mother with household duties which do not appeal to them.

Some girls work because they desire frills and luxuries which Dad does not see fit or is unable to bestow upon them. Other girls work because they are an exemplification of the spirit of independent American womanhood. However, we are safe in stating that in many cases, or perhaps in the majority of cases, single girls do need employment.

In the past few years, many married women have found it necessary to work in order to buy food for their children in those cases where it was impossible for their husbands to find employment. Other married women are working for the mere love and joy of the work. Again, others prefer outside work to home duties, while in some instances married women work to buy the luxuries their husbands cannot afford. Other married women have husbands who are not physically able to support them and they have shouldered the responsibility of maintaining the home.

Some telephone companies hesitate to employ married women, particularly if they have small children as they fear this will interfere with the attendance of the employe. This also holds true of single girls having smaller brothers and sisters who, upon occasion, may require their care.

And so the writer will leave it to you if this is not a question worthy of a Solomon's solution.

Questions from Illinois Operators

1. If your subscriber places a person-to-person call and his number does not answer, can he change it later to a station-to-station call?
2. When you report a "WH" on an alternate route, who is responsible for clearing the circuit?
3. Which makes the best operators, married or single women?
4. When Long Distance asks to talk to the operator and the calling party asks us to ring the subscriber, is it the right thing to locate the party, or should we notify Long Distance that her party wants us to ring a subscriber?
5. Why should "Customer Held" be encouraged?

The answers to these traffic questions are given on page 26.

▼ ▼

Telephone Man Sends International Fire Alarm

What may have been the first international fire alarm ever raised by intercountry telephone service occurred not long ago when a Canadian telephone man at Cardinal, Ontario, noticed a fire in progress and gaining headway on a then uninhabited island in the St. Lawrence River opposite that town.

Knowing that the two summer cottages on this island within the United States boundary line were owned by residents of Ogdensburg, N. Y., northern New York's largest river city a few miles distant, the telephone man called them by long distance, advising of the emergency and of what cooperative action could be made immediately to limit the destruction by the flames.

Moving Telephone Pole Lines in Preparation for Widening of Highway

Since the Iowa Highway Commission Has Decided to Make Nearly All of the Main Highways 100 Feet Wide, Instead of the Established 66 Feet, Many of the Telephone and Electric Companies of the State Are Being Asked to Move Their Poles Lines Out 17 Feet. Thus Writes W. H. Daubendiek, Secretary of the West Iowa Telephone Co., West Bend, Iowa, in a Letter Accompanying the Photographs Reproduced on This Page. They Show the Telephone Company's Outside Plant Men Engaged in the Task of Moving a 13-Wire Lead With the Aid of a Three-Ton Hoist Mounted on the Truck by Means of a 2½-In. Pipe Frame. Two Stiff Legs Are Mounted on the Rear and Set on Two Blocks to Take the Strain from the Truck When the Pole Is Pulled. The Truck Is Then Backed to a New Position. Mr. Daubendiek States That It Requires About 20 Minutes to Move a Pole. Sufficient Slack, He Adds, Must Be Cut in the Telephone Wires to Permit the Move.

Plant Men Get Together

The Uneventful Life of a Trouble-Shooter

By Doc

I realize full well that I have traveled far along life's eventful journey, although I have the satisfaction of knowing that I have always done my best and have been able at all times to obtain a certain amount of pleasure from my work—no matter how difficult it might be. I have come to realize that my trouble-shooting days are about over, for the old legs no longer respond to hiking as they did formerly.

I have no intention of retiring from the telephone game, I hope, for a great many years to come. Were I financially able I would not welcome retirement, for even old men should keep their minds occupied and I know of no better way than around an active telephone exchange. While I am willing to delegate the pole hiking to younger men, I still maintain that there are a lot of jobs which can be handled better by men of experience, gained by many years of hard knocks.

I hope that I may never degenerate into that type of individual who has lost his capacity for being able to separate the wheat from the chaff and who is unable to recognize a good new idea when he sees one. Some old men I have known never approve anything new just because it was not done that way when they were in their prime.

I realize that we old-timers did make a lot of mistakes. Many times, due to a lack of proper knowledge, we had to guess; and we considered that if we guessed right half the time we were doing as well as could be expected. The younger generation of telephone men have the advantage over our guessing; they can usually determine the correct method before starting something they have never done before. Then in the old days, it must be admitted that we were careless in a lot of ways—and this always costs money in any man's game.

I learned just the other day that one large telephone company requires that when one of its troublemen visits an exchange for the purpose of clearing a case of trouble, he must cover not only the instrument itself but also the inside wiring, the protector, the drop and cable terminal and make a thorough inspection and clear all conditions which might possibly cause trouble later. Then should there be a repeat on this particular station within a 30-day period a mark is placed against the troubleman's record. This is certainly a wonderful system. It no doubt prevents a lot of trouble and at the same time maintains a superior grade of service.

In contrast to this system, we in the old days might have a ticket on a certain telephone to replace a broken mouthpiece and that was all we would do, except possibly to call the wire chief and give him an O.K. This same instrument might have had a bell out of adjustment, a cracked receiver shell, or dirty connections in the cable terminal which would go bad the next week and require another visit of the troubleman. An inspection of the complete installation on the first visit would have placed the station in good condition and a second interruption of service, with annoyance to the subscriber, would have been prevented.

Of course, the present-day trouble car which carries a complete set of telephone repair parts, necessary tools and material is of great assistance to the troubleman. In the old days, when riding a bicycle to the subscriber's premises, one could not carry a large stock of parts or many tools.

Prevention of trouble or clearing it promptly when it does occur, is generally considered more important at the present time than it was when I was hopping trouble. However, subscribers in the old days would probably have appreciated their telephone service more had it always been dependable, for when a subscriber's telephone failed, it was

generally no more than was expected anyway.

Good telephone service in these United States at the present time is just taken for granted. Even minor interference or interruption to service is generally considered mighty serious by the subscribers and successful telephone companies must be on the alert at all times. I will wager, though, that these modern companies who keep abreast of the times with their material, tools and equipment, find it no more difficult to give A-1 service than we did the inferior grade in the horse and buggy days with our numerous handicaps.

▼ ▼

Farmer Knocks Out "Crosses" with Pole

After completing a job of transposing a farmer line in the eastern division of the New England Telephone & Telegraph Co., a line crew was on the way back over the side road when a farmer was noticed whacking away at the wires with a long pole.

He was asked what he was attempting to do, to which he replied: "Don't you see those wires crossed together up there? I'm trying to clear the trouble for you." At the location, the wires had a dip transposition in them and doubtless did look crossed to the inexperienced eye.

It was found, after talking with the farmer and explaining the reason for the transpositions, that he had had trouble with his telephone a short time before, had watched the repairman fix the trouble and, being very conscientious, believed he was doing the telephone company a favor in clearing a potential trouble for it.

▼ ▼

"I Wonder Why" of a Telephone Engineer

By Ray Blain

"I Wonder Why" only recently an effort has been made to develop a rubber-insulated parallel drop wire suitable for giving telephone service when buried in the ground?

This type of wire is still in the experimental stages although several test installations have been made and indications are that it will probably prove a success.

While detailed specifications on this new wire are lacking, the twin conductors are of No. 17 gauge annealed and tin-coated copper wire with an outer covering of rubber. The two wires of the pair are separated somewhat farther than in the parallel type drop wire. The insulation is rather heavy and dark in color. I understand this rubber is supposed to be free of all impurities such as sulphur. The secret of the success of the wire is to have the rubber insulation adhere firmly to the conductor so as to exclude all moisture.

The most interesting feature in connection with the use of this new wire is that it is plowed into the ground to a depth of about 18 inches in one operation. A special plow which can be drawn with trucks or a tractor at a speed of five to ten miles per hour, has a single revolving cutting disk at the front which cuts the ground's surface to a depth of three to five inches. A sort of a needle-eye point then feeds the wire into the ground to the required depth. As many as three wires may be laid at one time and the ground is closed by driving over it with a truck.

The wire comes in 3,000-foot coils. When improved transmission is required, special loading coils are connected to the line at specified intervals. These small coils are buried in the ground with the wire.

When a tap is taken off for a subscriber's connection a waterproof box or terminal is mounted on a post about two feet above the ground. The wires are fed up from the ground to the terminal through a small iron pipe. The tap is made on a suitable connecting block.

When it is necessary to make a splice in the line, the conductors are joined with sleeves and then covered with rubber which is vulcanized in places with a portable outfit that operates from a six-volt storage battery.

How this type of construction stands up under summer heat, winter freezing and alternate wet and dry soil remains to be seen, although from all present indications it has a fair chance of success. Should time prove that it is satisfactory, not only will it be ideal for use on rural lines but for underground connections in towns as well.

Flashes and Plugs--News Briefs and Comments

Elizabeth Dunn, telephone operator of Indianapolis, Ind., won the championship of the Indiana Women's Golf Association for the seventh time.

* *

Canadian brokers are using the long distance telephone extensively to sell gold mine stocks to American investors.

* *

Illinois newspapers report that many rural telephones cut off during the years 1930-1934 are now being put back into service.

* *

The comparative youth of the telephone is brought out in connection with the recent death of C. F. Kelleher, said to be the first telephone operator in New York City. That was in 1878 and there were but 15 subscribers in the city.

* *

At the Cleveland exposition the first telephone exchange in that city is recognized as one of the achievements in Cleveland's century of experience. There were 76 subscribers when the Cleveland exchange opened in 1879.

* *

Latest financial statistics show there are 26 companies in the United States in the billion-dollar class. Metropolitan Life Insurance Co., with assets of $4,234,000, leads the list. The Prudential Insurance Co. is second, and American Telephone & Telegraph Co. is third.

* *

Reports say that Toledo, Ohio, ranks second to San Francisco in the use of slugs in pay telephones. The Ohio Bell Telephone Co. stood the loss on slugs until the amount became too high. Now the owners of places where pay stations are installed sign an agreement to stand the loss resulting from the use of slugs or through other fraudulent methods. The company dumps approximately 200,000 slugs into the lake two or three times a year.

* *

It is reported in Chicago, Ill., that an organization calling itself the Doctors' Telephone Service, Inc., has petitioned the Federal Communications Commission for a radio channel to be used exclusively for emergency calls for physicians. The receiving device would be placed in the doctor's car.

* *

During the hot weather operators are wearing "shorts" in the Danville (Ill.) telephone office. Company officials are said not to be objecting to the fad, but Manager R. I. Gilleland said that no bulletin had been issued.

* *

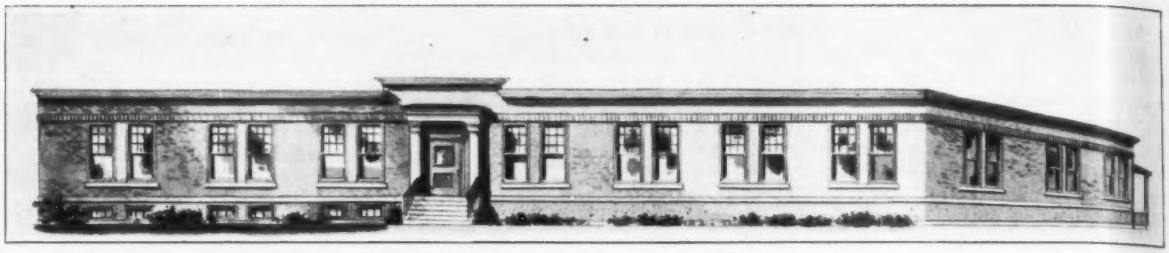
Washington—with 35.80 per 100 population—has more telephones per capita than any other city in the world. Increase in government employes in the last three years is the reason.

* *

Henry Ford says: "Not all the false prophets on earth can convince the American people that the American way is a bad way or that it cannot succeed. It is the real hope of all humanity, even now."

* *

At Berlin the Olympic Village had its own telephone system. The chief operator could speak in five languages.



New Office Building Planned for Phillips Electrical Works, Ltd., Brockville, Ontario, Can.

The Manufacturers' Department

Additions to Phillips Plant; Business Fast Increasing

Telephone officials throughout Canada will be interested to know of the extensive additional facilities which are planned for the plant of the Phillips Electrical Works, Ltd., at Brockville, Ontario, to take care of the increased telephone business which this company has enjoyed during the last year.

Two new buildings will be erected at an early date: one a new manufacturing unit approximately 90 feet by 150 feet in size, where the activities of the recently-added telephone manufacturing division of the organization will be centered; the other an office building approximately 50 feet by 100 feet in size, necessitated by the continued growth in the company's general wire, cable and copper products business. The total cost of these buildings will be close to $200,000.00, and it is expected that they will both be ready for occupancy by the first of November.

Officials of the Phillips company state that these additional manufacturing facilities will expedite deliveries of telephone instruments and equipment and place the company in a better position than ever to serve telephone organizations throughout the Dominion. The complete line of telephones now produced by Phillips, including the well-known Monophone models, has been accorded an unusually cordial reception by the telephone fraternity and it is the purpose of this 47-year-old organization to continue to adhere to its tradition of excellence and highest quality in presenting new models to the field as they are developed.

▼ ▼

Founder of Weston Company Passes Away

Dr. Edward Weston, famous inventor of dynamo-electric machines and founder of the Weston Electrical Instrument Co., died at his home in Montclair, N. J. ,August 20, after suffering a cerebral hemorrhage. Dr. Weston was 86 years of age and in recent years had served as chairman of the board of directors of the Weston company.

Migrating to the United States from England when a young man of 20, he secured a job as chemist for the American Nickel Plating Co. Later he invented several dynamo-electric machines and in 1875 established at Newark, N. J., the first factory in America devoted exclusively to the production of that type of machine. During a period of 11 years he secured patents on 300 inventions.

In 1888 Mr. Weston founded the Weston Electrical Instrument Co., at Newark, N. J., which for nearly half a century has manufactured and shipped electrical measuring instruments of great precision and accuracy to all parts of the world. After serving in the capacity of vice-president for 17 years, Mr. Weston became president of the company in 1905. In recent years, as mentioned previously, he had been chairman of the board.

A charter member of the American Institute of Electrical Engineers, Mr. Weston was, in 1888, elected president. In 1924 he was awarded the medal of the Franklin Institute for his inventive genius. He held honorary degrees from McGill University, Stevens Institute of Technology, Princeton, and the University of Pennsylvania.

▼ ▼

Universal Telephone Set Produced in Belgium

The wide variety of telephone sets which it has been necessary to manufacture and stock has presented a difficult problem to telephone manufacturers and operating telephone companies. Three different methods of operation—namely,

To the Left Is Shown the Universal Telephone Set Arranged for Local Battery Table or Desk Mounting: To the Right Is Another Arrangement of the Same Set for Local Battery Wall Mounting. These Sets Are Readily Convertible to Common Battery Operation.

Strowger Automatic Telephones

Telephone users, connected to public exchanges or to private exchanges for inter-departmental communication; Telephone Administration executives responsible for the provision of a high standard of service, and maintenance staffs who must keep equipment operating without fault or failure . . . all these people, and many more, find relief from irritations and anxieties where Strowger equipment is installed.

Strowger equipment has been manufactured at Strowger Works, Liverpool, England, for

British Post Office
South African Post Office
Indian Government
Polish State Telephone Administration
Lithuanian State Telephone Administration
Australian Post Office
Bombay Telephone Company Ltd.
Anglo-Portuguese Telephone Company Ltd.
Jamaica Telephone Company Ltd.
Etc., etc.

whilst Private Exchange equipment has been supplied to many hundreds of Offices, Factories, Institutions, Stores, Ships, and the like.

ATM
REG. TRADE MARK

Automatic Electric Company Ltd.

Strowger Works, Liverpool, 7, England

Associated Company and Export Distributors

The International Automatic Telephone Co., Ltd.,
Norfolk House, Norfolk Street, Strand, London, W. C. 2, England

local battery, common battery manual, and automatic— together with the need for sets for both table and wall mounting, are the causes for so many varieties.

The Bell Telephone Mfg. Co., Antwerp, Belgium, according to Electrical Communication for July, has taken a notable step towards the alleviation of this condition by the production of a new convertible bakelite set. The illustrations presented on page 24 show two uses for what is fundamentally the same set; one being a local battery handset for table or desk use and the other being a local battery handset for wall mounting.

Common battery manual sets arranged for table and wall mounting respectively, would look the same as those illustrated except that the generator crank would be omitted and the crank hole would be covered.

It will be evident that a table set may be converted into a wall set, or vice versa, simply by rotating the microphone cradle 180 degrees. This flexibility is achieved by inclining the plane of the cradle mounting surface at an angle of 45 degrees with the plane of the set mounting surface.

In case the set is required for automatic operation, a dial adapter is placed under the dial when wall mounted and omitted when table mounted. Thus the correct dial angle can be readily obtained, regardless of the position in which the set may be mounted. Magneto sets may be converted to manual common battery sets by changing the induction coil and omitting the generator crank.

The addition of a dial and dial adapter when necessary, converts the common battery manual telephone into an automatic set.

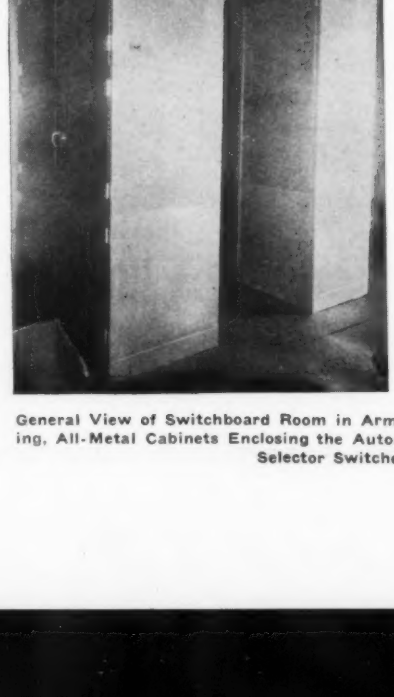
New Telephone Building at Arma, Kans., in Which Automatic Electric Equipment Has Been Installed.

Automatic Electric System Installed at Arma, Kans.

Occupying an attractive new stucco-finish telephone building, Automatic Electric equipment was recently cut into operation at the Arma, Kans., exchange of the Crawford Telephone & Telegraph Co. of Girard, Kans., and represents the first step in this company's use of automatic equipment.

This installation consists of 100 lines of Automatic Electric line-finder equipment. Five-frequency harmonic ringing is used, which permits full selective signaling up to ten stations per line. The exchange is operated on a totally unattended basis, supervisory signals being extended over one of the regular two-way trunks to the attended exchange at Girard. Duplicate ringing interrupters, with arrangements for remote-control switching of either of these sets into operation from Girard, are provided.

One two-way trunk is provided to the manual board at Mulberry, and both the Mulberry and Girard operators, having dials mounted on their keyshelves, can dial Arma subscribers direct. Power for operating the exchange is furnished by a 100-ampere-hour storage battery maintained in a charged condition by means of an Automatic Electric five-ampere full-wave battery charger.



General View of Switchboard Room in Arma, Kans., Exchange. Note the Neat-Appearing, All-Metal Cabinets Enclosing the Automatic Apparatus.—Close-up View of Strowger Selector Switches at Arma, Kans.

Answers to Traffic Questions on Page 21

1. No.
2. The OTC operator. The TTC operator should include the words, "Alternate Route" in passing the WH report if she has used an alternate route in reaching a direct toll center in order that the OTC operator will know that she must clear the circuit.
3. Please refer to the preface to the questions on page 21.
4. The calling party should be notified to signal his operator and place a call with her for the party he wishes to reach.
5. Because the "Customer Held" method gives the customer the best possible toll service and results in a saving of toll circuit time and operator's time.

Recent Prices in the Metal Markets

New York, N. Y., August 24: Copper—Quiet. Electrolytic spot and future, 9.75c per lb.; export, 9.60c. Tin—Steady; spot and nearby, 42.25@42.37½c per lb.; future, 41.37@41.50. Lead—Steady; spot New York, 4.60@4.65c per lb; East St. Louis, 4.45. Zinc—Dull; East St. Louis, spot and future, 4.80c.

Personal Notes From the Field

W. G. McAVOY, of Albia, Iowa, manager of the local exchange of Iowa State Telephone Co. for the past three years, has been promoted to the position of general manager of the Central Carolina Telephone Co. and Coastal Telephone Co. at Southern Pines, N. C. These are subsidiaries of the Investors Telephone Co., which also owns the Albia exchange. As general manager Mr. McAvoy has supervision of 21 exchanges in the Carolinas.

Mr. McAvoy has been one of those most active in Albia community enterprises since going there in May, 1933. He was president of the Albia Commercial club; first aid and safety chairman of the Monroe county chapter of the American Red Cross, of which he was formerly chairman; president of the Big Brothers class of the Methodist Bible school; and a member of the Rotary club, of which he has been vice-president.

▼

ROBERT SILER DuRANT, of Southern Pines, N. C., has recently been made vice-president and general manager of the Iowa State Telephone Co., of Newton, Iowa, and vice-president in charge of operations for the parent company, the Investors' Telephone Co., whose headquarters are in Chicago, Ill.

For the past eight years Mr. DuRant has served as vice-president and general manager of the Central Carolina Telephone Co., one of the subsidiaries of the Investors' Telephone Co. At Newton, Iowa, Mr. DuRant succeeded H. R. Christianson, resigned to accept a similar position at Muskegon Mich., of vice-president and general manager of the Michigan Associated Telephone Co.

Mr. DuRant was born in Union County, N. C., July 7, 1893. He was educated at the Presbyterian College of North Carolina, Clinton, S. C. During the vacation periods, in the years when he was attending college, Mr. DuRant was employed as lineman by the Southern Bell Telephone & Telegraph Co. and the Duke Power Co. Upon leaving college, he was employed by the Western Electric Co. for a year, in connection with the installation of the central office equipment at the main exchange in Spartanburg, S. C.

He again entered the service of the Southern Bell, May 19, 1916, and in the ensuing years held positions in the accounting, commercial and plant departments, as well as in the division commercial office of the state of North Carolina. On March 1, 1928, after nearly 12 years with the Southern Bell, Mr. DuRant resigned to accept the position of vice-president and general manager of the Central Carolina Telephone Co. When the Coastal Telephone Co. was acquired by the Central Carolina, in October 1933, he was appointed vice-president and general manager of that company.

In July of this year Mr. DuRant was elected vice-president of the Investors' Telephone Co. in charge of operations for all subsidiary companies. The Investors' company (formerly known as the Standard Telephone Co.) operates 122 exchanges, with 36,000 telephones in eight states, namely, Iowa, Missouri, Wyoming, Nebraska, Arkansas, North and South Carolina and New Jersey.

Mr. DuRant has been a member of the North and South Carolina Independent telephone associations since their organization. He is now a member of the board of directors of the Iowa Independent Telephone Association. He also is a member of the Kiwanis Club, the Newton Chamber of Commerce and the Masonic Order.

▼

MERVEN BEN SMITH (or "Ben" Smith, as he is more generally known) for nearly seven years general directory sales supervisor for the Southwestern Bell Telephone Co., at St. Louis, Mo., has been transferred to Dallas, Texas, as directory supervisor.

Mr. Smith's nearly 12 years of experience with the Southwestern Bell have been marked by a succession of promotions. Entering the company's ranks, on August 6, 1924, as student, he was made assistant to the general directory supervisor some nine months later, November 1, 1925.

January 1, 1928, he became general directory sales supervisor. In November of that year he was appointed division directory supervisor at Kansas City, Mo. In June, 1929, he was made directory advertising supervisor at Topeka, Kans. Three months later he was transferred back to Kansas City as directory sales supervisor. Then a few weeks later he was sent to St. Louis as general directory sales supervisor. He remained in that city for nearly seven years—until his recent promotion to Dallas, Texas, as directory supervisor.

Mr. Smith is a Georgian by birth, the city of Macon recording his birth Au-

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gust 13, 1904. He was educated at the Porter Military Academy. Prior to entering the employ of the Southwestern Bell company, Mr. Smith was engaged for a time as newspaper reporter for the Augusta (Ga.) Chronicle. Later he was sporting editor for the Anderson (S. C.) Tribune. Subsequently, he was employed as a salesman for a short time.

He is a member of the National Federation of Sales Executives.

DONALD McMILLAN MONG, for many years affiliated with the Mutual Telephone Co., of Erie, Pa. and its successor, the Pennsylvania Telephone Corp.—and recently telephone engineer for the Public Service Commission of West Virginia—has been appointed general commercial superintendent of all subsidiary companies of the Investors' Telephone Co., with operating headquarters at Newton, Iowa.

Mr. Mong's first employment in the telephone business was in November, 1917, with the Mutual Telephone Co. in Erie, Pa., the city which marked his birth on December 22, 1902. During the succeeding years he was employed in many departments of the company.

In 1926 he was graduated from Lehigh University, in South Bethlehem, Pa., with the degree of electrical engineer. While an undergraduate in college, he was admitted to the honorary fraternities of Eta Kappa Nu, Tau Beta Pi and Phi Beta Kappa. Upon his graduation from college Mr. Mong was appointed assistant to the commercial manager of the Mutual company at Erie, Pa.

Upon the acquisition of the Mutual company and the Johnstown (Pa.) Telephone Co. by the Associated Telephone Utilities Co. and the organization of the Pennsylvania Telephone Corp., he was made commercial manager for the Johnstown district which included not only the properties of the Johnstown company but also those of the Windber Telephone Co. and the Western Pennsylvania Telephone Co. In April, 1933, he was appointed general commercial superintendent for the Eastern operating group of the Associated company.

In December, 1935, he became telephone engineer for the Public Service Commission of West Virginia. The latter part of July Mr. Mong assumed the duties of his recent appointment as general commercial superintendent for the Investors' Telephone Co.

Mr. Mong is a 32nd degree Mason and a member of the Kiwanis Club. Golf and aviation are his hobbies. He has built a number of airplane models, including a gasoline powered six-foot flying model and holds a student's flying license.

PATIENCE

By MISS ANNE BARNES

Traveling Chief Operator, Iowa Independent Telephone Association, Des Moines, Iowa

PATIENCE may be defined as watchful waiting for the realization of some desired thing to come to pass. Patience is not a passive but rather an active state of mind, constantly alert and waiting hopefully for a given thing to happen.

We must not confuse patience with sullen endurance. Patience is courageous, while sullen endurance is tinged with resentment. In the mad hurry of today we should remember that patience is just as important a factor in man's success and happiness as it ever was.

For instance, I heard a bus driver speak very impatiently to a timid, frail and bent little woman because she had been misinformed about a change she would have to make in order to reach her destination. As a result, she did not make the change until the driver told her bluntly to get off. Then he was very impatient with her because she could not recognize her baggage up in the rack. Just a short time previously, I had seen her tenderly treated by her daughter when she put her on the bus. So this scene prompted me to write on the subject "Patience," hoping it may serve as a reminder that patience is very much needed in the mad hurry of present living.

Instead of patiently striving for success in what we hope to attain, we drive on to this, that, and the other adventure, thus failing to accomplish much of anything out of the ordinary. "Oh, I haven't the patience!" we exclaim. "I can't wait forever and a day! Life is too short." "All right! All right! All right!" as Major Bowes says.

But the cat gets her mouse more often than she fails to do so. She is the best example of patience I know of. She does not give up watching for the mouse that has escaped into a place of safety too small for her to enter. She doesn't concern herself about the interior of the hole or whether there is another way out for the mouse. And she doesn't go looking for another mouse.

She camps right down before the hole and waits patiently for the mouse to come forth, as has always happened throughout her mousing experience. She knows the mouse will come out finally if for no other reason than to see if she is still there.

There is no other vocation in which patience is more important than in that of the telephone operator. Hundreds of times a day she has to hold herself in check.

MORAL: "Patience is bitter but its fruit is sweet."—Rousseau.

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Condensed Telephone News

New Companies and Incorporations

MARENGO, IOWA.—The Citizens Telephone Co., through amendment of its articles of incorporation has changed its name to Iowa Standard Telephone Co. with its principal place of business at Marengo.

Financial

NEW YORK, N. Y.—The board of directors of the General Telephone Allied Corp. has declared a dividend of $1.75 per share on the $6 preferred stock of the corporation, payable September 1, 1936, to holders of record at the close of business on August 20, 1936. The dividend is a payment on arrears for the period July 16, 1934, to October 31, 1934.

Telephones

CINCINNATI, OHIO.—July station gain of the Cincinnati & Suburban Bell Telephone Co. totaled 553, bringing total stations in operation at the end of the month to 167,227. Stations in operation at the end of July, 1935, totaled 152,726.

PHILADELPHIA, PA.—The Bell Telephone Co. of Pennsylvania reports a July station gain of 1,108 against a loss of 3,387 in July, 1935. As of July 31, there were 1,098,402 Bell telephones in Pennsylvania.

Construction

MARION, WIS.—The Urban Telephone Co., with headquarters at Clintonville, will soon start the erection of a new storage building 40 ft. by 60 ft. with cement floor and concrete block walls. It will be entirely fireproof. J. H. Spengler is secretary and general manager of the company.

Miscellaneous

ALBANY, ILL.—Gerald Hill, formerly of Fulton, is now the manager of the Albany Telephone Co., succeeding Floyd E. Wilson, who has moved to Rock Island.

CLINTON, IND.—Earl Talbott, manager of the Indiana Bell Telephone Co. here and at Rockville, Dana, Mecca and Montezuma, was unanimously elected president of the Clinton Exchange Club at the annual meeting of that organization. Mr. Talbott advances to the presidency from the position of vice-president which he held last term. This will be his second term as president of the Exchange club, his first having been for the first six months of 1933.

HIBBING, MINN. — Extension of the Town of Stuntz Telephone System to serve a group of farmers living at the Wilpen location, eight miles northeast of here, has been given final ratification by members of the township board.

The matter has been under consideration for several months and came to a head as several of the farmers of the district appeared before the board at its regular meeting. With the new addition to the telephone system the township will be providing service to 150 farmers of the district.

LEBANON, OHIO.—John T. Wilkerson, local manager of the Ohio Central Telephone Corp., has resigned his position. Mr. Wilkerson was with the Lebanon exchange for the last 12 years succeeding the late John H. Thompson.

APPLETON, WIS.—In recognition of the completion of 45 years of service with the Wisconsin Telephone Co., James F. Hobbins of Appleton, district foreman for the company, was recently presented with a diamond service emblem by William R. McGovern, president of the company.

Mr. Hobbins entered communications work for the company June 1, 1888, as central office telephone switchboard operator. Subsequently he held successively, the positions of installer, repairman and collector. From September 1, 1890, to November 1, 1893, he was absent on leave and re-entered the service of the company as groundman. In 1899, following service as lineman and assistant foreman, he was appointed foreman. In 1905 he received his present assignment.

Mr. Hobbins was born and raised in De Pere, Wis., and received his early education there.

Elections

REEDY, W. VA.—Stockholders of the Reedy Citizens' Telephone Co. at their annual meeting in early August reelected all officers as follows: President, I. S. McCoy; secretary, E. M. Waldeck, treasurer Roy McCutcheon; operator, Ernest Fore.

Obituary

CARBONDALE, ILL.—Aubrey Everet Boswell, age 42, manager of the Illinois Commercial Telephone Co. here the last five years, died at Holden hospital on August 12. Death was due to poisoning of his system resulting from a carbuncle on the hip.

Mr. Boswell was born at Trenton, Tenn. on January 23, 1894. He had been with the Illinois Commercial company for about 12 years. He returned to Carbondale five years ago from Eldorado, where he was manager of the company's exchange. He was member of the Carbondale First Baptist Church and of the Masonic order. He is survived by his widow, Mrs. Ada Boswell; his mother, Mrs. L. A. Boswell of Carbondale; two sisters, Mrs. T. A. Ware of Jackson, Tenn., and Miss Florence Boswell of Carbondale; and three brothers, Frank Boswell, Alabama; Theodore Boswell, Carbondale, and Marion Boswell, Anna.

NEW YORK, N. Y.—William Forbes, stock transfer of the American Telephone & Telegraph Co., with which he had been associated since 1906, died at his home in Allendale, N. Y., on August 3 at the age of 56. Born in Dundee, Scotland, Mr. Forbes came to this country in 1900. He studied law at Northeastern College in Boston, and later was admitted to the New York bar. His widow, two children, William and Jean, three sisters and two brothers survive.

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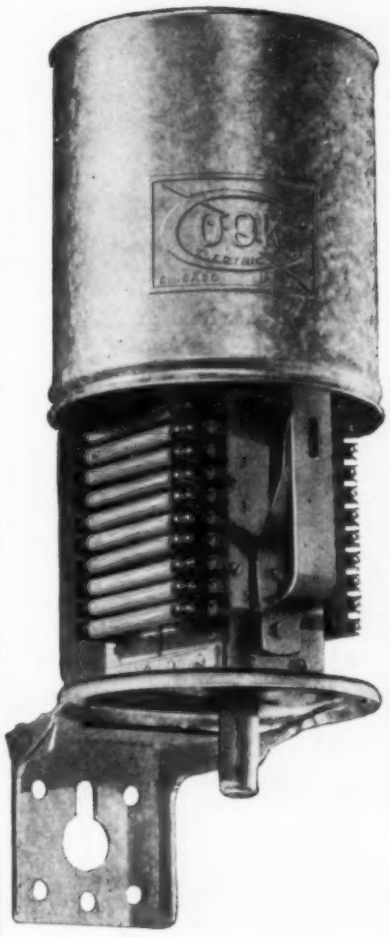

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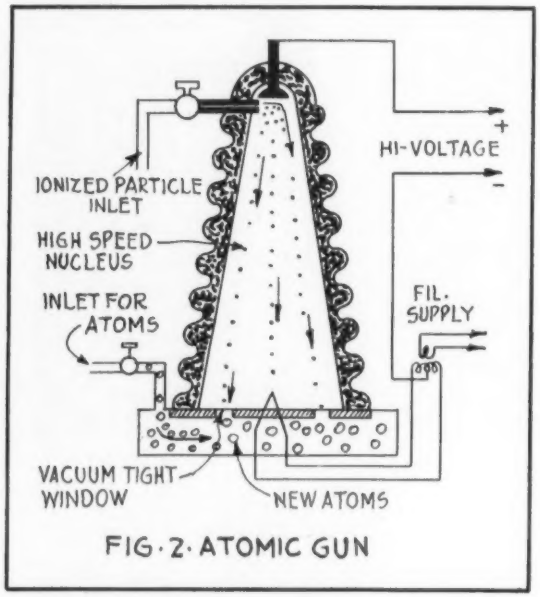
Telephony's Engineering Data

By B. C. Burden

The new machine consists essentially of a clever means for causing the bombarding projectile to revolve in an ever-increasing circle while energy is periodically imparted to the moving projectile by a relatively low-voltage oscillatory source. In order that the projectile move in a curved path, an intense magnetic field is required to deflect it.

Some of the machines that have recently been built for



FIG·2·ATOMIC GUN

transmutation experiments have made use of gigantic magnets originally used for Poulsen arc wireless transmitters.

Other Phases of Transmutation

Another interesting phase of transmutation is the fact that radioactive elements can be created by this process.

It was discovered in 1934 that often in bombarding an element a new element is formed which is *unstable*, with the result that it would soon start disintegrating of its own free will. With this disintegration, the unstable element would emit rays similar to those thrown off by radium.

"Telephony's" Engineering Data

By B. C. Burden

The length of time of the spontaneous emission of radium rays after bombardment was found to vary from a few seconds to several months.

Radium emits rays indefinitely, although theoretically it will eventually stop emitting and turn into lead.

The medical world will be greatly benefited by a cheap substitute for radium which it now seems certain will some day be available. In many respects the substitute will be more useful than radium itself as its limited life would permit injecting it directly into the tissue to be treated. Radioactive material has already been made from ordinary table salt.

Summary

Summing up our discussion of transmutation, we can say that the principles have been proved and future work will be concerned primarily with developing means for cheaply transmuting sufficient quantities of the various elements to make the process worthwhile.

We should recognize that the products of transmutation may be of two types:

1. Changing one element into another element.
2. Changing a stable element into an element which is unstable and which emits radium rays.

It is rumored that Germany is working night and day on apparatus that will make transmutation possible on a large scale.

Miscellaneous Data

Table Showing Feet Per Pound of Magnet Wire.

Gauge No., B. & S.	Single Cotton-Covered	Double Cotton-Covered	Plain Enameled	Single Silk-Covered
14	79	77	80	79
16	125	122	125	127
18	198	192	202	201
20	311	298	319	318
22	489	464	506	505
24	765	711	804	798
26	1,190	1,080	1,280	1,260
28	1,850	1,630	2,030	1,990
30	2,860	2,420	3,220	3,130
32	4,370	3,500	5,100	4,900
34	6,520	4,920	8,080	7,650
36	9,940	6,660	12,800	11,900
38	.....	.....	20,300	.....
40	.....	.....	32,100	.....

"Telephony's" Engineering Data

By B. C. Burden

Theory of Vacuum Tube Testing

The increasing importance of the vacuum tube in the communications field warrants a better understanding of this important electronic device on the part of the average telephone man. In previous data sheets, the theory of the various types of vacuum tubes has been discussed. This data sheet covers the theory of vacuum tube testing.

This is an important phase of the duties of those responsible for maintenance on vacuum tube equipment used in telephone plants. Apparatus, such as telephone repeaters and carrier equipment, having vacuum tubes which are in operation 24 hours a day, requires frequent testing to insure the tubes are in serviceable condition.

Effect of Poor Tubes on Reception

Before considering the theory of tube testers, let us examine for a moment the effect of bad tubes on radio reception. "Poor tubes" may take the form of those which cause *noisy reception*, tubes which result in substantial *distortion*, and tubes which result in *weak reception*. We might, of course, add still another type of defective tube; namely one which is *completely inoperative*.

Three Types of Tube Faults

There are three general types of tube faults. These are: mechanical, gas in tubes, and loss of emission. Mechanical faults due to loose contacts may be between the base contacts and the internal elements of the tubes, or the elements may be out of line due to either improper assembly or to a severe jar which will often misplace the elements. Elements improperly supported or supported in such a manner that they vibrate, due to being mechanically excited by the loudspeaker which is contained in the same cabinet, will often cause trouble in a radio.

Gas in the tubes may be due to imperfect "pumping" or bombardment at the factory or due to a leaky seal. Loss of emission results from either over voltages applied to tubes for short periods or a natural wearing out of the tube.

Tube testing may be divided into three general classes: electrical tests, emission tests and mutual conductance tests. Modern tube testers are designed to facilitate quickly making all of the three classes of tests just mentioned.

Testing Ten Thousand Miles of Electrician's Tape

In one year the American telephone industry uses enough electricians' tape to make a strip around the United States with enough left over for three or four highways between New York and San Francisco. How the industry has devised scientific tests to tell whether these enormous lengths of tape are first-class in quality is described in a recent report by W. H. S. Youry of the Bell Telephone Laboratories.

Every householder has used electricians' tape to wrap wires, to make temporary repairs to gas tubes or bicycle tires, or even to patch an unexpected hole in coats or pants. This tape is almost as common nowadays as bailing wire used to be on western ranches.

Good tape must do three things: It must hang on tightly when it has been applied. It must be sticky enough to cling to itself but not too sticky for easy use. These qualities must last as long as possible before use, so that tape kept a year or so will be of some good.

To test the sticking qualities of the tape, the Bell Telephone Laboratories have machines that measure just how much force is needed to pull two pieces apart. Stickiness is tested by slapping two strips of tape together in the air to see how well they stick. Spoiling of tape by age is tested by cooking a sample for some hours in a hot box at 160 degrees, results of this test being found to agree reasonably well with the damage worked by longer time at lower temperatures.

Mr. Youry's associates find that the wrappings of tinfoil, cellophane and so on, which many manufacturers put around the rolls of tape and without which many householders will not buy it, are of no use in making the tape keep longer. Plain, unwrapped tape is just as good.

The Latest Book!

"Inductive Coordination of Electric Power and Communication Circuits"

by LAURENCE J. CORBETT

Member, American Institute of Electrical Engineers, Fellow, American Association for the Advancement of Science

is the **only one** combining under one cover the essentials of this important subject involving many divisions which have been treated separately and occasionally in numerous reports and articles. It includes results of the author's researches, fitted into a broad survey of the principles applying to Inductive Coordination. It is NOT a compilation of catalog data or undigested reports. It is a carefully developed treatment and clarification of a subject which, though important, has received too little attention. Many diagrams illustrate the practical application of the principles in a manner very readily followed. The variation in values of factors is presented, and theory and practice under these conditions are carefully differentiated.

CHAPTER HEADINGS:

I. Elements of the Problem.
II. Susceptiveness and Coupling Factors.
III. Effects of Conductor Arrangements.
IV. Transpositions.
V. Coordinated Transpositions.
VI. Telephone Circuits on Power Structures.
VII. Power System Wave Shape.
VIII. Transformer Exciting Current and Bank Connections.
IX. Flow of Residual Currents.
X. Control of Residuals.
XI. Miscellaneous Values and Remedial Measures.
XII. Susceptiveness Factors.
XIII. Low-Frequency Methods.
XIV. Miscellaneous Methods.

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CORDS, CABLE AND WIRE

Lenz Electrical Manufacturing Co., 1751 N. Western Ave., Chicago—Established 1904—telephone and switchboard cords for all makes of equipment, braided and lead-covered telephone cable, flame-proof jumper wire, interior telephone wire, switchboard wire.

CORDS AND WIRE

Runzel Cord & Wire Co., 4727-31 Montrose Ave., Chicago — Telephone and Switchboard Cords, Flame-proof Jumper Wire, Switchboard Wire, Interior Telephone Wire. W. L. Runzel, President, has devoted over 40 years to the making of fine telephone cords.

POLES

B. J. Carney & Co., 100 N. 7th St., Minneapolis, Minn.—Western red cedar poles. Pentrex Butt Treated or Plain.

International Creosoting and Construction Co., Galveston, Texas — Creosoted Southern Yellow Pine Poles. Plants: Beaumont and Texarkana, Texas.

Jordan Bros. Lumber Co., Box 84, Norfolk, Va.—Virginia White Cedar Poles. Plain or charred and creo-treated butts.

MacGillis & Gibbs Company, Milwaukee, Wis.—Northern White and Western Red Cedar Poles. Plain or butt-treated. Immediate quotations on request.

T. M. Partridge Lumber Co., Minneapolis, Minn.—Northern White—Western Red Cedar Poles. Plain or butt treated.

H. Sigalet & Company, Ltd., Lumby, B. C., Canada—Western Red Cedar Poles. Plain or Butt treated.

Valentine Clark Corporation, 2516 Doswell Ave., St. Paul, Minn.—Finished Cedar Poles. Plain or Butt treated.

Activities of Commissions and Courts

Three Companies Classed as "Connecting Carriers"

The Telephone Division of the Federal Communications Commission on August 21 announced its action on the examiner's report, in the cases of the Intra State Telephone Co., of Galesburg, Ill., the Princeton Telephone Co., of Princeton, Ind., and the Capital City Telephone Co. Each company in the FCC orders is "hereby classified as a connecting carrier and as such is subject to sections 201-205 of the Communications Act of 1934."

The decisions in the cases of the former two companies were made on August 13 and in the case of the Capital City company on August 14.

▼ ▼

FCC Rules Against Bell Purchase of Independent

The telephone division of the Federal Communications Division on August 21 announced that on August 13 it approved an order denying approval of the sale of the Northwestern Indiana Telephone Co. of Valparaiso, Ind., to the Crown Point Telephone Co., Crown Point, Ind., for $514,707. This case was the first to come before the commission asking approval of the purchase of an Independent property by the Bell.

The commission found that the sale of the company at the price stipulated would not be in the public interest. The joint petition of the telephone companies for approval of the sale was denied without prejudice to the rights of the petitioners to amend the petition or to file a new petition.

▼ ▼

FCC Shake-Up Reports Termed "Propaganda"

Chairman Paul A. Walker of the telephone division of the Federal Communications Commission on August 21 asserted that reports purporting to cast reflection on the work, the character of the evidence produced, or the personnel investigating the A. T. & T. Co., "are nothing more than insidious propaganda, intended to discredit the investigation and dishearten the personnel."

Without denying that the directing personnel of the investigation would be changed, Mr. Walker said that statements as to the purported changes were unauthorized and without any official sanction.

Commissioner Walker's statement of August 21 follows:

"The telephone investigation is going forward with full speed, with a splendidly qualified and highly capable staff of assistants. It is a tribute to regulation that so able a group of men could be assembled in so short a time for this most important utility investigation now before the country.

Stories purporting to cast reflection upon the character of the evidence produced or the personnel are nothing more than insidious propaganda tending to discredit the investigation and dishearten the personnel.

Statements as to the purported supplanting as counsel of Samuel Becker, a brilliant lawyer of high integrity, and the forced resignation of John H. Bickley, chief accountant and recognized as one of the very ablest accountants engaged in utility regulation, are wholly unauthorized and without any official sanction whatever.

Much good has already been accomplished for the public by the investigation, and by the valuable and high-class evidence produced. The investigation will continue to go forward without letup, and its result will merit the commendation of telephone users and all those sincerely interested in the protection of the public through utility regulation."

▼ ▼

Studying Leased Wires Cost for Radio Stations

Rates charged by the American Telephone & Telegraph Co. and associated Bell companies for wires leased to radio broadcasting companies are under scrutiny by officials of the Federal Communications Commission in connection with the telephone investigation, according to the Wall Street Journal. The FCC has received returns from all broadcasting companies in response to a questionnaire.

When public hearings are resumed in the inquiry this fall, this will be one of the first matters on which A. T. & T. officials will be questioned, it is reported.

Agitation in Congress, led by former Senator Clarence C. Dill, of Washington, against what was termed the "excessive" cost to broadcasting companies of leased wire service, was one of the direct causes of the A. T. & T. investi-

gation. Senator Dill asserted that the cost of telephone service was such that smaller radio stations were deprived of network programs by the "prohibitive" cost.

David Sarnoff, president of Radio Corporation of America, recently stated that the cost of telephone wire service to the National Broadcasting Co. was in excess of $5,000,000 annually. The Columbia Broadcasting System, it is believed, pays nearly that amount annually.

▼ ▼

Hearing on Oklahoma City Rates September 8

The Oklahoma Corporation Commission will begin formal hearings on September 8 in a move to adjust telephone rates in Oklahoma City. Reford Bond, commission chairman, and A. S. J. Shaw, commissioner, signed the order over the protest of Jack Walton, third member. Mr. Walton did not specify his objections.

An order setting the hearing was filed on August 6 as the culmination of an investigation begun June 18, 1931, under a $50,000 appropriation from the legislature. The investigation resulted in an order in May, 1935, reducing telephone charges in Tulsa an estimated $60,000 a year. This case was appealed to the state supreme court.

The order pointed out that the commission's technical staff "has been engaged for several months" in an appraisal of the company's property in Oklahoma City and in a study of its earnings and operating expenses.

The hearing originally was set for September 4 but was changed to September 8 at the request of the company's attorneys.

The local investigation is part of a statewide rate inquiry sponsored by William H. Murray when he became governor in 1931. Although the commission began with an initial appropriation of $50,000, a second appropriation was voted in 1933 to continue the work.

▼ ▼

Franchise in Dallas, Texas, Still Unsettled

The Dallas, Texas, city council has decided to leave to a popular referendum next spring the decision of whether to accept an offer of the Southwestern Bell Telephone Co. to pay 4 per cent gross receipts tax for 1936 in return for a renewal of its franchise. Accordingly, the city council voted five to four against an ordinance which would have peremptorily imposed the tax on the company without regard to the franchise offer.

The Associated Leagues West of the Trinity, which opposes the franchise and played a leading role in demanding the referendum, indicated it would insist that the city levy the tax by ordinance.

C. L. Stewart, division superintendent, announced the telephone company's decision to pay the back tax in the event the franchise should be approved.

"Any action which will complicate the telephone franchise matter, or which will impose an unfair assessment on telephone users will be resisted," he said. "But if Dallas voters approve the city council's recent action in granting a franchise to the Southwestern Bell Company, the 4 per cent gross receipts tax for 1936 will be paid."

▼ ▼

Tried and Fined Over Telephone Line

Police Judge W. J. Duncan of Stanford, Ky., believes he holds a world's record from a legal aspect—he tried a case by telephone.

When E. H. Cummings, Mount Vernon, Ky., was unable to appear in Stanford to answer charges of drunkenness and unloading coal within the city limits without a license, he went to the office of County Judge Charley Carter at Mount Vernon and explained his plight.

Judge Carter obliged him by calling

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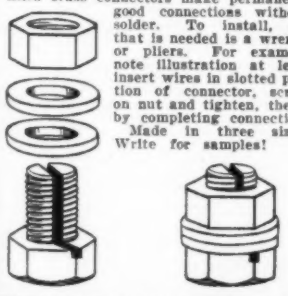
A loose or rusty connection on a telephone line causes high resistance and as a result, transmission of sound over that line is unsatisfactory.

Allen brass connectors make permanent, good connections without solder. To install, all that is needed is a wrench or pliers. For example note illustration at left: insert wires in slotted portion of connector, screw on nut and tighten, thereby completing connection. Made in three sizes. Write for samples!



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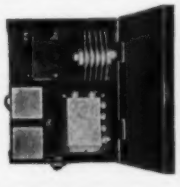

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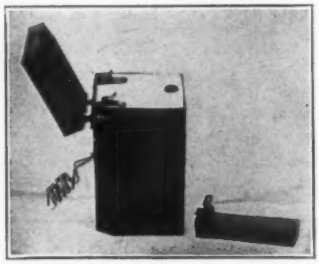

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EXPERIENCED line and repair man wants work or will lease a place on monthly payments. Go anywhere; good references. Address 8554, care of TELEPHONY.

POSITION WANTED—Young man, telegraph and telephone inside maintenance and engineering experience. Have excellent record in Bell, foreign and international service. Address 8488, care of TELEPHONY.

ATTENTION telephone company executives! Here is a qualified young telephone man, age 31, with excellent connections and references. He has had exceptional training and experience with Independent companies, traffic, commercial and central office management. Desires to make a change to a company appreciating competence and loyalty. Address 8529, care of TELEPHONY.

POSITION WANTED—Seven years' Bell traffic experience, university graduate, age 31. Thorough knowledge of modern engineering and operating practices, dial and manual; administrative duties. Address 8511, care of TELEPHONY.

Judge Duncan, explaining that Cummings could not reach Stanford in time for his trial and suggested he try the case then and there, asserting he would vouch for the defendant.

Within four minutes the trial was over and Judge Duncan assessed a $5 fine for drunkenness and $15.50 for a city license. The defendant paid the money to Judge Carter, who said he would remit it to the Stanford judge.

▼ ▼

Commission Rulings and Schedule of Hearings

Federal Communications Commission Washington, D. C.

August 12: Southern Bell Telephone & Telegraph Co. filed with the Telephone Division a telephone wire certificate requesting authority to supplement existing facilities in the vicinity of Copper Hill, Ducktown and Cleveland, Tenn.

August 13: Telephone Division, in acting upon the examiner's reports on the Intra State Telephone Co., of Galesburg, Ill., and the Princeton Telephone Co., of Princeton, Ind., held that each company is "classified as a connecting carrier and as such is subject to sections 201-205 of the Communications Act of 1934."

August 14: Telephone Division, acting on examiner's report, ordered that the Capital City Telephone Co., of Jefferson City, Mo., "be and the same is hereby classified as a connecting carrier and as such is subject to sections 201-205 of the Communications Act of 1934."

August 21: Telephone Division announced its order of August 13 denying approval of the sale of the Northwestern Indiana Telephone Co., of Valparaiso, Ind., to the Crown Point Telephone Co., of Crown Point, Ind.

Arkansas Department of Public Utilities

August 8: Order issued approving a voluntary reduction in long distance tolls of the Southwestern Bell Telephone Co. The annual savings under the new rates will amount to about $46,000 to Arkansas patrons of the telephone company, effective September 1.

Ohio Public Utilities Commission

Augus 12: Authority granted the Cincinnati & Suburban Bell Telephone Co., effective September 1, to amend its toll tariff to provide for a reduction of toll overtime rates after the first three minutes of overtime on day, night and Sunday person-to-person calls, this reduction being to the basis of station-to-station calls and on Ohio intrastate business of this company, amounting to a reduction from five to three cents per minute.

September 10: Hearing on petition filed by the Ohio Central Telephone Co., pleading for authority to abandon its central exchange office at Iberia in Morrow county and that it be permitted to serve that area by party lines from its Mt. Gilead exchange. The petition set forth that the Iberia exchange serves but 44 subscribers and that the territory will not develop additional business, resulting in unprofitable operation.

Oklahoma Corporation Commission

September 8: Opening of hearings at Oklahoma City on investigation into local rates of the Southwestern Bell Telephone Co.